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THE FOREST RESOURCES of NEW HAMPSHIRE

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U. S. DEPARTMENT OF AGRICULTURE

Forest Service
United States Department of Agriculture
Forest Resource Report No. 8

ACKNOWLEDGMENT

The survey of the forests of New Hampshire was made by the Northeastern Forest Experiment Station of the U. S. Forest Service, Upper Darby, Pa., in cooperation with the New Hampshire State Forest and Recreation Commission. The commission and the Brown Co. of Berlin, N. H., provided the aerial photographs that were used. Extension Forester K. E. Barraclough and the county foresters of New Hampshire, particularly Robert H. K. Phipps, made a special supplementary study of timber quality. All this assistance is gratefully acknowledged.

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UNITED STATES DEPARTMENT OF AGRICULTURE

FOREST RESOURCE REPORT NO. 8 WASHINGTON, D. C., 1954

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The Forest Resources of New Hampshire

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NORTHEASTERN FOREST EXPERIMENT STATION, D. C.
FOREST SERVICE

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Preface

THROUGH the McSweeney-McNary Act of 1928, Congress authorized the Secretary of Agriculture to conduct a comprehensive survey of the forest resources of the United States. This work was assigned to the Forest Service. The purposes of this forest survey are (1) to make a field inventory of the present supply of standing timber; (2) to ascertain its current rate of growth; (3) to determine how much it is being reduced through industrial and domestic uses, fire, and other causes; (4) to estimate the present consumption and the probable future trends in requirements for forest products; and (5) to interpret and correlate these findings so that they may be useful in formulating private and public forest policies.

Results of this first comprehensive survey of the forest resources of New Hampshire are reported here. However, other estimates of the State's forest inventory have been made in the past, the most recent being the "Reappraisal" of 1945, which was made by the Forest Service in cooperation with the American Forestry Association. These previous estimates were based largely on general knowledge and on the judgment of informed persons; the present survey is based on a scientifically designed procedure using aerial photographs and ground plots. Furthermore, some specifications used in this report are different from those used in previous studies. For these reasons changes in forest conditions in New Hampshire cannot be determined by comparing this report with previous estimates. Valid comparisons of changing forest conditions in New Hampshire will be possible when the same area is resurveyed in the future.

Most of the fieldwork in New Hampshire was carried out in 1947 and 1948. Additional information on timber quality and timber cut was obtained in 1952.

The facts in brief

A FOREST ECONOMY

New Hampshire is one of the most extensively forested States; 84 percent of its land area is covered with forests. Its economy depends heavily on these forests. One out of every five workers in the State depends on the forests, either directly or indirectly, for his livelihood.

THE FOREST INDUSTRIES

Some 700 forest enterprises operate in New Hampshire. They put intense pressure on the forest resource. The pulp and paper mills have to import large quantities of pulpwood and woodpulp. Lumber and veneer are imported. And some industries have trouble finding the kinds of raw material they need.

FOREST OWNERSHIP

Private owners hold most of the forest land in New Hampshire—85 percent of it. Most of the forest properties are small. The pattern of private ownership and small holdings creates special problems in improving management and in utilizing the forest resource efficiently.

TIMBER VOLUME

New Hampshire's commercial forests contain 10 billion board-feet of timber. A third of the volume is white pine.

CONDITION OF THE FORESTS

The forests of New Hampshire have survived 300 years of hard usage. But now small trees predominate; and, for the State as a whole, the volume of growing stock per acre is only fair. There is a large volume of hardwood cull.

GROWTH AND ANNUAL CUT

Net growth exceeds timber cut, but this is nothing to be complacent about because the land is actually growing trees at a rate far below its capacity. Softwood sawtimber is being cut faster than it grows. Most of the excess growth is in small hardwood trees.

AN OPPORTUNITY

Where growth exceeds timber cut, as it does in New Hampshire, there is an excellent opportunity to rebuild the forest resource. Increasing use of hardwoods by industry brightens the prospects for balancing the timber budget. Remedial measures are suggested for improving the management and utilization of New Hampshire's forests.

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Why Forests Are Important To New Hampshire

NEW HAMPSHIRE is one of the most extensively forested States of the Union. Of its total land area, 84 percent is covered with forests. The economy of the State leans heavily on this forest resource. And New Hampshire forests make a strong contribution to the economy of New England.

But this is not all. Everywhere, growing populations, with rising standards of living, will make increasing demands upon natural resources. For example, shortage of softwoods is already worldwide. A State endowed, like New Hampshire, with an abundance of forest land can look forward to supplying the needs of people far beyond her borders—and profiting by it.

Employment

New Hampshire has a labor force of about 200,000 persons, according to the 1950 census (*13*).[1] One out of every five of them depends, either directly or indirectly, on the forest resource for his job.

The 1950 census showed that 10,000 persons work in manufacturing lumber and furniture and other wood products. Manufacture of paper and allied products is estimated to provide jobs for another 7,000 (*8*). Besides these, a fairly large number of farmers and persons in other occupations work part time in harvesting timber—probably at least 3,000 of them (fig. 1). Thus the basic wood-using industries of New Hampshire provide jobs directly for at least 20,000 persons.

It is generally true that for every one person employed in commodity-producing industries, one is also employed in the service industries: transportation, utilities, personal and business services, and the like. Thus another 20,000 persons depend indirectly on the forest resource for their jobs.

Income

The stumpage value of the annual timber harvest in New Hampshire—income that flows to the owners of forest land—is estimated at more than $5 million. About 80 percent of this comes as a return from sawlog stumpage. The rest is the stumpage value of standing timber that is harvested for veneer logs, cooperage and turning bolts, pulpwood, posts, poles, fuelwood, and other timber products.

But most of the income attributable to the forest resource comes after the timber has been cut. The income of the persons employed in the basic wood-using industries was about $45 million in 1949. This was estimated from employers' reports (*14*) on payrolls taxable under the Federal Insurance Contributions Act, adjusted to account for earnings that were not taxable.

This figure does not include the incomes of self-employed persons or the profits of corporate businesses. Accurate data on these are not available; they were estimated at $5 million. At least another $45 million income in the trade and service industries can be attributed indirectly to wood-using industries.[2] Thus in 1949 a total of about $100 million was generated by New Hampshire's forest resource.

Inasmuch as 1949 income payments to individuals were about $600 million (*4*), one may fairly conclude that $1 out of every $6 that go into the pockets of New Hampshire's people can be traced, either directly or indirectly, to the utilization of the forest resource.

Other Forest Values

Although the forest survey was concerned primarily with the timber resource, other forest values may be of equal—or greater—importance to the economy of

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[1] Italic numbers in parentheses refer to Literature Cited, p. 28.

[2] The 1947 Census of Manufactures (*11*) found that in New Hampshire's timber-based industries the value added by manufacture totaled $60 million.

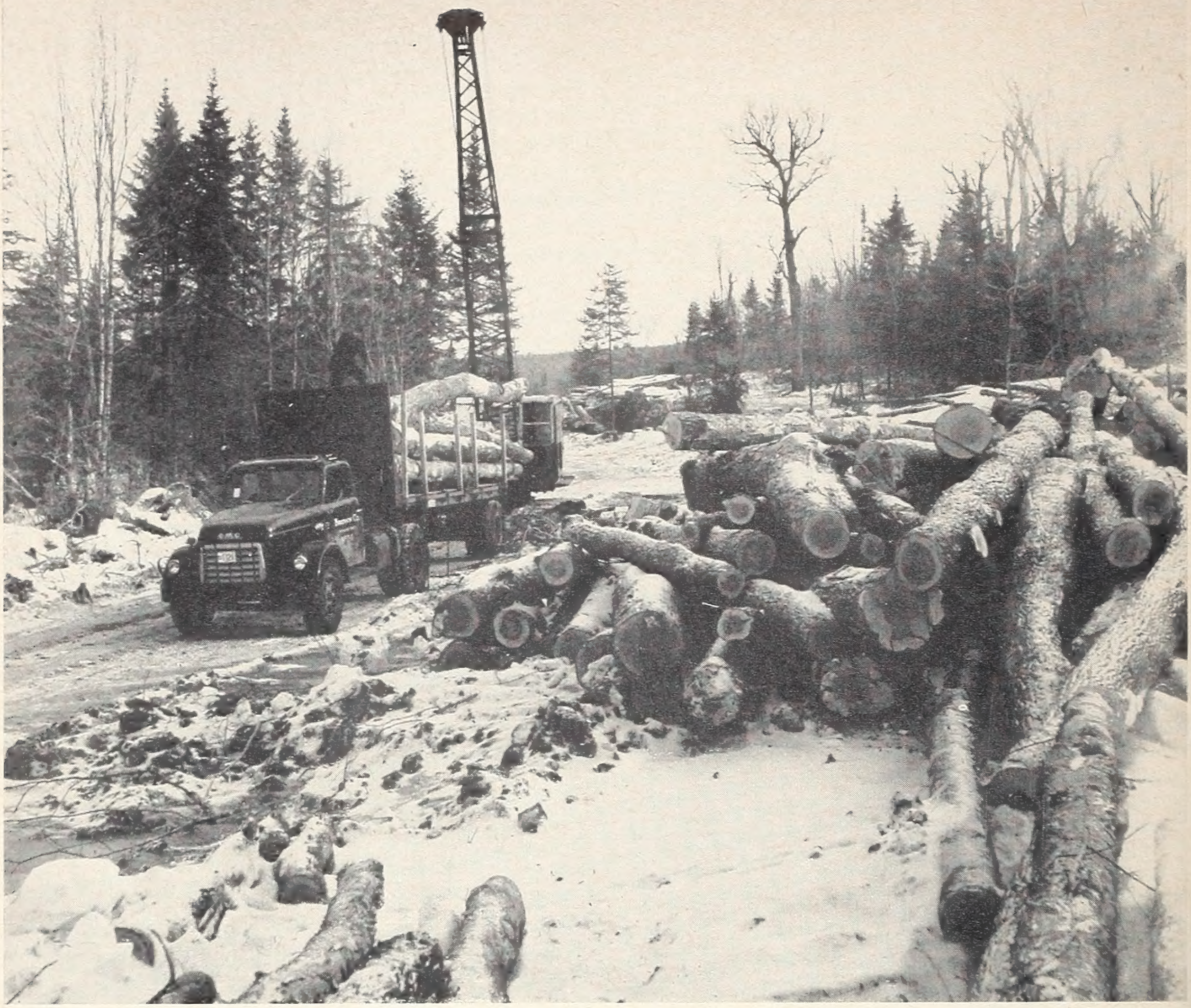

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FIGURE 1.—*The forest resource provides jobs for a large segment of New Hampshire's labor force. It is estimated that $1 out of every $6 that go into the pockets of New Hampshire's people can be traced, directly or indirectly, to the forests.*

New Hampshire. One of these is the value of forests as watersheds.

Water

Water is a natural resource that is as essential to any region's economy as timber or coal. For example, a pulp mill that manufactures 100 tons of bleached sulfite pulp per day needs about 15 million gallons of good water daily—about the same amount a city of 100,000 people uses for domestic purposes. Virtually all industry depends on a supply of good water.

Like the rest of New England, New Hampshire relies rather heavily on waterpower for electrical energy. Practically all of the hydroelectric plants in New Hampshire are run-of-the-river plants; they operate on the natural flow of the rivers, without large storage reservoirs to regulate the flow. In low-water periods emergency methods must sometimes be used to provide electrical power.

Good forest cover on watersheds helps to store water in the soil and reduce flood runoff. Where the forest floor has a deep layer of humus, rainwater and snowmelt seep down through it—even though the soil is frozen—and are stored in the soil. The water is released gradually, and thus streamflow is maintained during dry periods. On poor watersheds the water runs off quickly, eroding the land and causing floods (fig. 2). The rivers and streams fed by poor watersheds often provide too much water, often not enough.

The forested watersheds of New Hampshire present some problems in watershed management: How to protect them from fire and heavy cutting in order to retain the best watershed conditions for leveling off streamflow? How to use watersheds for timber production without endangering quality of water supplies?

Recreation

New Hampshire's forested mountains and its tree-lined lakes and streams attract thousands of visitors to the State. Along with the climate and the scenic beauties, these forest settings make New Hampshire a popular vacation land. Besides hunting, fishing, and

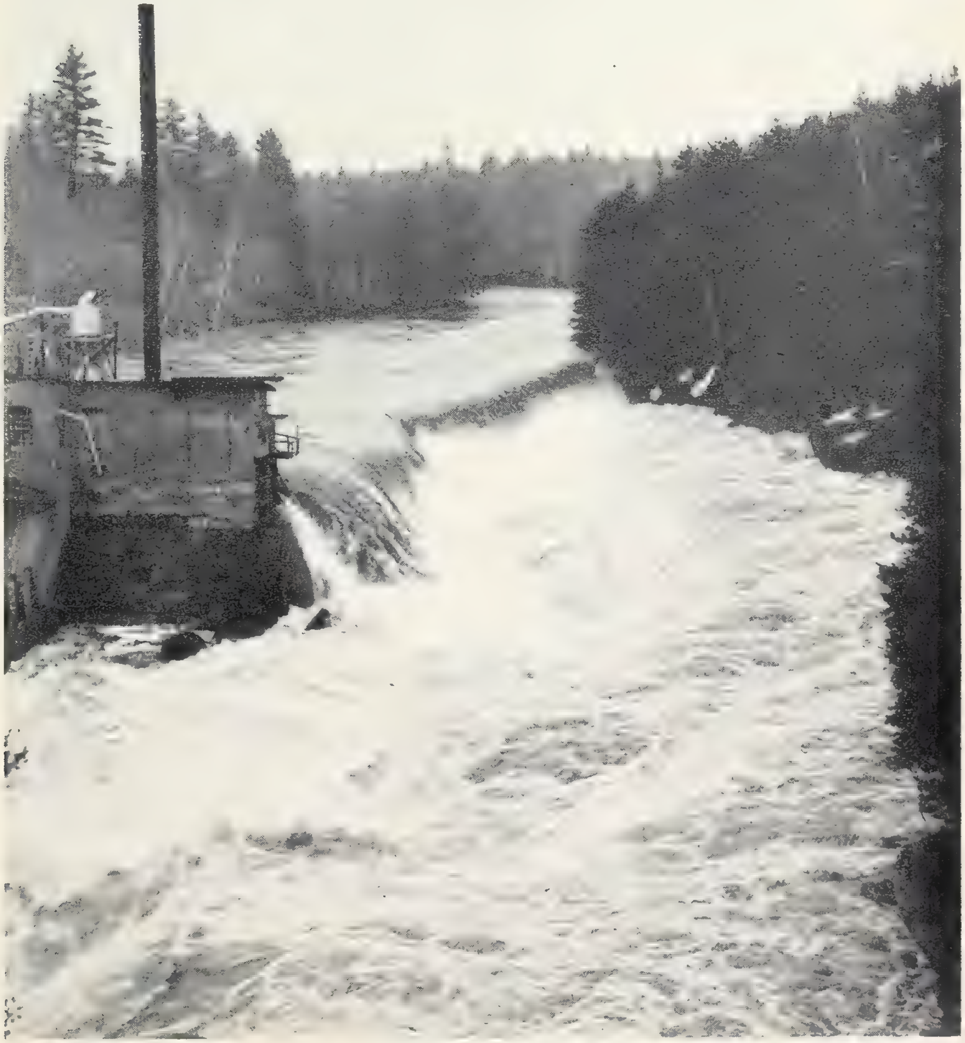

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FIGURE 2.—*The water resource is largely a product of forested watersheds. New Hampshire's streams often provide too much water, often not enough.*

the traditional summer recreation activities, skiing and other winter sports are highly popular pursuits (fig. 3).

The recreation industry has brought new wealth to many economically distressed communities. It now ranks as one of the chief sources of income for the people of the State. In 1949 this industry provided jobs for at least 5,000 persons, and the total expenditures of vacationists in New Hampshire have been estimated at $70 to $80 million annually (*6*).[3] Of course it is impossible to say what part of this can be attributed to the forests. But without them, this industry would not be anywhere near as large as it is now.

Forest recreation, including hunting and fishing, and other uses of the forest land—especially timber growing and water supply—sometimes conflict with each other. Unsightly slash areas may mar the enjoyment of nearby picnic spots. Forest properties may be posted against hunting because some hunters are careless with fire. The problem is how to resolve these conflicts so that the forest may serve people's needs for recreation, water, and wood as efficiently as possible.

F–443785

FIGURE 3.—*Forests help to make possible a recreation industry that has brought new wealth to many communities.*

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[3] For 1952, the New Hampshire State Planning and Development Commission estimated that vacationists in the State spent $138 million (*3*).

The Forest Industries

EXCEPT IN the pulp and paper industry, most of the wood-using mills in New Hampshire are small. Of some 700 firms that reported employment and payrolls in 1949, only 4 percent had 100 or more employees (*14*). About 90 percent of them had fewer than 50 employees, and 40 percent operated with 3 or less.

More than 500 sawmills operate in New Hampshire. They are concentrated in the southern part of the State (fig. 4); however, the northern mills are generally larger. The three pulp mills in New Hampshire are all located in the northern part of the State.

The Lumber Industry

Lumber production in New Hampshire reached its peak—750 million board-feet—in 1907. Then it fell to a low point of 130 million board-feet in 1932. Since then production has risen steadily, and in the years 1946 through 1952 it averaged nearly 350 million board-feet annually. More than half of the cubic volume of timber harvested in the State in 1952 went to sawmills to be cut into lumber. (Fig. 5.) Much of this lumber in turn became material for various other wood-using industries.

The sawmills have always drawn heavily on the softwood growing stock. The forest survey showed that lumber production breaks down by species this way:

	Lumber production (percent)
White pine	73
Hemlock	12
Spruce, fir, and others	4
All softwoods	89
Yellow birch	4
Sugar maple	3
Red oak	2
Beech	1
Other hardwoods	1
All hardwoods	11

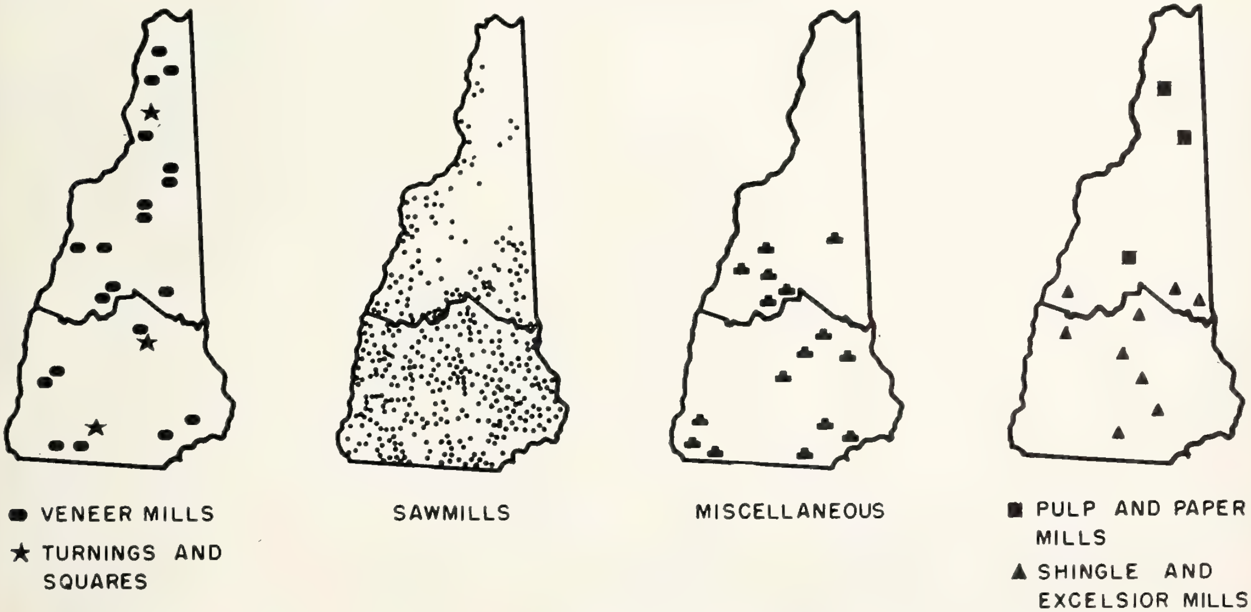

FIGURE 4.—*The general distribution of primary wood-using industries in New Hampshire. The sawmills are clustered in the southern part of the State.*

F-377179

FIGURE 5.—*Demands for lumber put heavy pressure on the forests of New Hampshire—especially on the pine. More than half of the timber volume harvested is sawed into lumber.*

The depression of the 1930's gave the softwood growing stock some time to recover. But the hurricane of 1938 caused a heavy loss of pine in some parts of the State. And under the heavy demands of World War II and the postwar years, pressure has been put on the softwoods again, especially on pine. The problem now is how to sustain a reasonable rate of softwood lumber production without depleting the softwood growing stock beyond recovery.

Hardwood lumber production accounts for only 11 percent of the total output, even though 39 percent of the sawtimber volume available is hardwood. Quality is the rub. The problem is how to market low-quality material.

Hardwood lumber is used chiefly for manufacturing fabricated products; and producing lumber for this use requires proper milling facilities, sawing for grade, and good seasoning. Most small sawmills in New Hampshire are not equipped to turn out high-quality standard hardwood lumber.

The Pulp and Paper Industry

The economic contribution of the pulp and paper industry is far greater than is indicated by the amount of wood it uses (fig. 6). Employment and earnings in pulp and paper mills are higher, per unit of wood used, than the average for the other wood-using industries in New Hampshire. It is doubtful that any of the State's other natural resources generates wealth more effectively than pulpwood.

Pulpwood production in New Hampshire has gone through two drastic slumps in the past 35 years, one in 1916–24, the other in 1926–32. Since 1932, production has steadily increased to its present level of about 250,000 cords annually. This upward trend seems likely to continue, because pulp-mill capacity has been increased recently. Even more important is the recent introduction of new processes that have increased the use of hardwood for pulp. In 1947, for example, hardwoods constituted only about one-fifth of the 242,000 cords of total production. In 1952 about one-third of the pulpwood harvested was hardwood (*1*).

Even though heavily forested, New Hampshire doesn't produce all the pulpwood its mills consume. For example, in 1947 the pulp and paper industry consumed 199,000 tons of woodpulp. But to fill its need, it imported 79,000 tons—25,000 tons of pulp and the pulp equivalent of 54,000 tons in pulpwood (fig. 7). This means that not more than 60 percent of the new wood fiber used in the manufacture of paper in the State is supplied by New Hampshire's own forests.

Of course there is no economic virtue in being self-sufficient if it is cheaper to get raw materials from outside. Parts of Maine can furnish pulpwood more cheaply than distant parts of New Hampshire. Parts of Canada are also nearby sources of supply for the pulp and paper mills.

The supply situation is complicated somewhat because a number of out-of-State mills draw pulpwood from New Hampshire. All in all, the State has a net deficit in pulpwood supplies.

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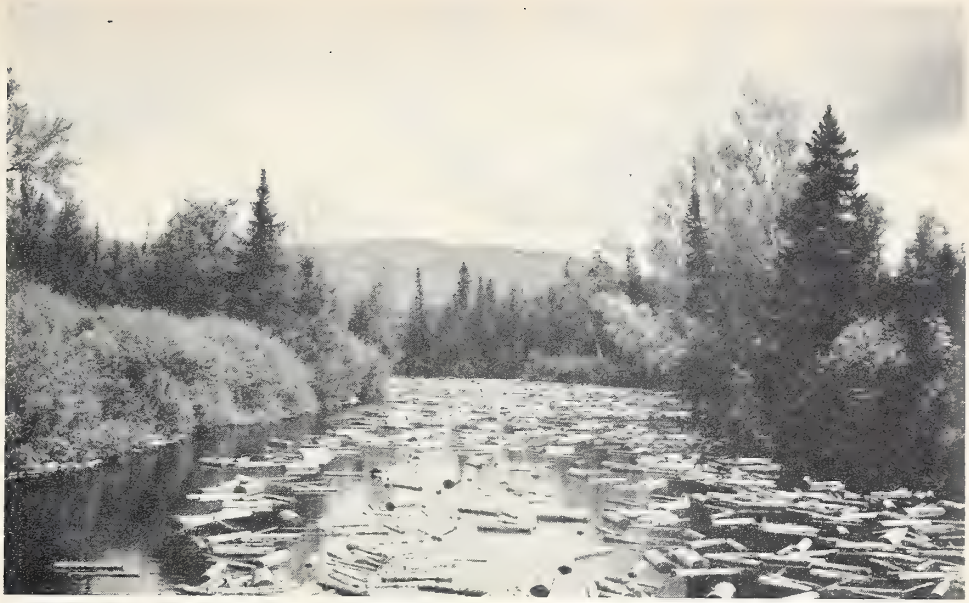
FIGURE 6.—*The pulp and paper industry makes an important contribution to the economy of New Hampshire. Here pulpwood from Maine and northern New Hampshire is carried to a New Hampshire paper mill by the Androscoggin River.*



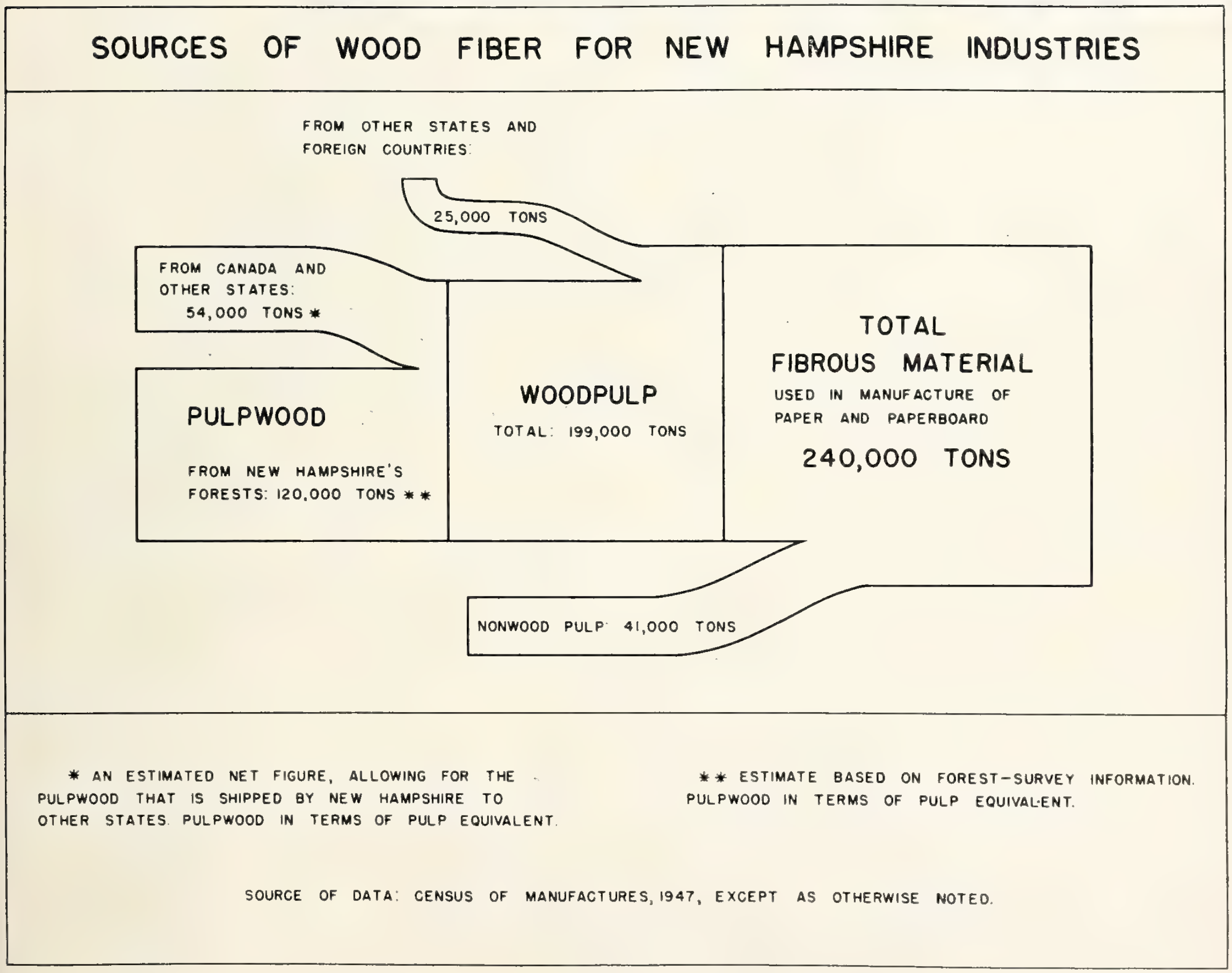

SOURCES OF WOOD FIBER FOR NEW HAMPSHIRE INDUSTRIES
FROM OTHER STATES AND FOREIGN COUNTRIES:
25,000 TONS
FROM CANADA AND OTHER STATES: 54,000 TONS *
PULPWOOD
FROM NEW HAMPSHIRE'S FORESTS: 120,000 TONS * *
WOODPULP
TOTAL: 199,000 TONS
TOTAL FIBROUS MATERIAL
USED IN MANUFACTURE OF PAPER AND PAPERBOARD
240,000 TONS
NONWOOD PULP: 41,000 TONS
* AN ESTIMATED NET FIGURE, ALLOWING FOR THE PULPWOOD THAT IS SHIPPED BY NEW HAMPSHIRE TO OTHER STATES. PULPWOOD IN TERMS OF PULP EQUIVALENT.
* * ESTIMATE BASED ON FOREST-SURVEY INFORMATION. PULPWOOD IN TERMS OF PULP EQUIVALENT.
SOURCE OF DATA: CENSUS OF MANUFACTURES, 1947, EXCEPT AS OTHERWISE NOTED.

FIGURE 7.—*Despite New Hampshire's large area of forest, its paper mills import a large part of their raw material.*

Other Wood-Using Industries

An assortment of other kinds of wood-using industries operate in New Hampshire. Approximately 60 plants produce such products as excelsior, veneer, shingles, cooperage, small dimension, turnery stock, handles, etc.

Most of these mills are rather small, yet they are very important to many small towns and villages because the majority of them are owned and operated locally. Practically all of the income from them stays in the community. All together, they provide jobs and income for more than one-tenth of the employees in New Hampshire's wood-using industry.

The supply of raw material is a major problem for these small mills. Many of them depend on one or two species. A turnery, for example, may use only paper birch. Many mills can operate only with material that meets strict specifications of quality and size. To get the raw material they need, some mills haul timber long distances. Some are willing to pay premium prices for logs and bolts of suitable quality.

The Forest Resource

The Forests of the Past

SOME 300 YEARS AGO, when settlement by white men began, nearly all of New Hampshire was covered by forests. The early settlers cleared timber off land they needed for crops. They felled huge quantities of fine timber, but only a small part of it was put to any use. Most of it went up in smoke.

The forests gradually gave way to a teeming community of small farms and villages. There were no large cities, no industrial populations. Almost everyone was engaged in farming. By present standards the farms were small and very poor; back in the hill country, land was tilled that would not be farmed at all today.

About 1830 many farmers turned to raising beef cattle and sheep. More land was cleared, this time for pasture. By 1855 only about half of the State's total land area was covered with forests (*5*). Meanwhile, the railroads came to New Hampshire about the time the hill-country farmers turned to stock raising, and they were responsible for far-reaching changes in the economic life of these people. The railroads brought in cheaper foodstuffs and fiber from the West. Manufacturing cities grew up rapidly, and scores of New Hampshire towns lost people to them. Reluctantly but steadily, year after year, the hill-country farmers abandoned their land.

These abandoned farmlands were good timber-growing sites, and the forests reclaimed them. But because of the condition of the soil and other factors such as grazing, these "old-field" forests had some unique characteristics. Instead of the original mixture of softwoods and hardwoods, much of the land reforested to pure stands of softwoods. In the southern part of the State and in the Connecticut River Valley, the old-field stands were predominantly white pine. In the northern sections and at some higher elevations, spruce took over in the old fields.

The rapid industrial expansion of New England in the early 1800's had a lasting effect on the forest resource. It created a demand for timber products such as never had been known before. After 1830 lumber production went up dizzily. The steam sawmill, replacing the old waterpower mills, helped the boom along, and the railroad and other new equipment made possible large-scale logging operations. The railroad also opened up eager new markets for New Hampshire timber—even as far south as New York City.

Lumber production reached its peak in 1907, then began to decline, chiefly because the better and more accessible stands had been depleted by cutting. Production fell below 300 million board-feet in the twenties, and it did not rise above this level until 1939 (fig. 8). Salvage operations after the 1938 hurricane gave production a boost; then came the demands of World War II.

The pulp and paper industry grew up along with the lumbering industry. By 1907 the pulp mills were consuming wood at the rate of 430,000 cords per year, most of which came from the spruce-fir forests in the northern part of New England. As previously mentioned, the pulpwood production trend has been upward since 1932.

The history of New Hampshire's forests shows the strong preference for softwoods. Pine, hemlock, and spruce have been preferred for lumber, and spruce and fir for pulpwood. Hardwood timber was often left standing to take over the land after the softwoods had been cut. Much of the lumber produced in recent years has come from the old-field softwood stands.

The Forest Area Today

Now forests again dominate the landscape in New Hampshire. The nonforest area has shrunk to 16 percent of the total land area (table 1). Today all but two counties—Rockingham and Strafford—are more than three-fourths forested, and even these two counties have more than 70 percent of their land area in forest. The commercial forest land of New Hampshire covers 4.7 million acres—81 percent of all the land in the State.

Only a small part of the forest land is not suitable or available for commercial timber growing. This

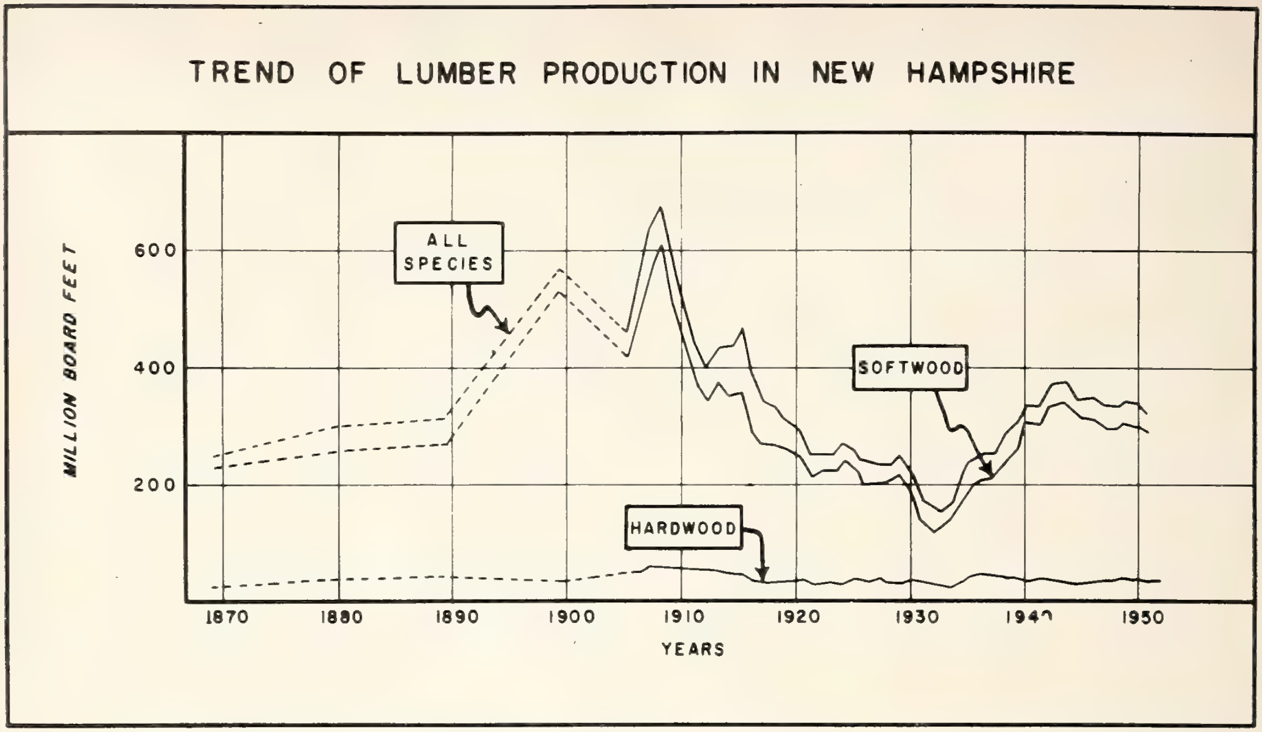


FIGURE 8.—*Since it hit a low point in 1932, lumber production in New Hampshire has risen steadily. The curves are based on a 3-year moving average.*

TABLE 1.—*Forest-land area of New Hampshire, by county, 1948*

County	Forest area			Nonforest area	Total land area [1]
	Commercial	Noncommercial	Total		
	Acres	*Acres*	*Acres*	*Acres*	*Acres*
Belknap	206, 400	1, 500	207, 900	48, 700	256, 600
Carroll	525, 400	9, 100	534, 500	65, 800	600, 300
Cheshire	389, 700	3, 600	393, 300	65, 600	458, 900
Coos	984, 200	60, 500	1, 044, 700	123, 300	1, 168, 000
Grafton	866, 400	77, 000	943, 400	155, 500	1, 098, 900
Hillsboro	442, 300	9, 300	451, 600	118, 000	569, 600
Merrimack	480, 200	3, 000	483, 200	112, 700	595, 900
Rockingham	327, 200	1, 200	328, 400	113, 800	442, 200
Strafford	179, 400	400	179, 800	61, 500	241, 300
Sullivan	281, 000		281, 000	62, 700	343, 700
Total	4, 682, 200	165, 600	4, 847, 800	927, 600	5, 775, 400

[1] U. S. Bureau of the Census (*10*).

includes public forest land that has been withdrawn from timber use because it is more valuable for recreational use, and unproductive forest land such as upper mountain slopes above the the range of commercial timber growth.[4]

Ownership

Most of the commercial forest land in New Hampshire (85 percent) is held by private owners. The rest is owned by Federal, State, and local public agencies.

Private

There are about 35,000 private forest-land owners (table 2). The great majority of their forest properties are small, less than 5,000 acres—most of them probably are from 50 to 200 acres in size. Generally, these small forests are owned not by farmers, but by business and professional people, housewives, clerks, laborers, and the like. Many of them hold forest land for purposes other than timber production (*2*).

Farm forests account for less than one-fourth of the commercial forest land. Many of the smaller farms probably include no more forest land than they need to supply their own fuelwood, fence posts, and other home-use materials.

The larger holdings account for not more than 13 percent of the commercial forest land. Nine owners hold forest properties of more than 25,000 acres each.

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[4] This and other Forest Survey terms are defined in the appendix.

Two of these, both pulp and paper companies, each own more than 100,000 acres. The other large owners are pulp and paper companies, a hardwood specialty manufacturer, an estate, a college, and a sportsman's club.

TABLE 2.—*Ownership of commercial forest land in New Harrpshire, 1948*

Ownership class	Commercial forest-land area	
	Acres	*Percent*
Private:		
Farm forests:[1]		
On 5,900 farms of 100 acres and more[2]	861, 300	18
On 4,500 farms of less than 100 acres	178, 200	4
Total	1, 039, 500	22
Industrial and other forests:		
9 holdings larger than 25,000 acres	601, 100	13
13 holdings of 5,000 to 25,000 acres	138, 500	3
24,000 holdings smaller than 5,000 acres[3]	2, 220, 700	47
Total	2, 960, 300	63
All private (about 35,000 holdings)	3, 999, 800	85
Public:		
National forest	580, 400	13
Other Federal	5, 200	(4)
State	44, 500	1
Town, city, and county	52, 300	1
All public	682, 400	15
Total, public and private	4, 682. 200	100

[1] Census of Agriculture, 1950.

[2] Estimated on the assumption that all farms of 100 acres or more contain forest acreage. Farm size class refers to gross acreage, including nonforest land.

[3] Estimated on the basis of sampling procedure.

[4] Less than 1 percent.

Public

Of the publicly owned commercial forest land, 580,400 acres are in the White Mountain National Forest.[5] This land was purchased by the Federal Government under the Weeks Act to assure protection of important watersheds and sustained production of timber. The forest is managed to serve both of these purposes as well as recreational use and game production.

New Hampshire has a system of small State-owned forests and parks that include 44,500 acres of commercial forest land. These forests and parks are occasionally added to by purchase and gift. The towns, cities, and counties own 52,300 acres of commercial forest land. Although tax-foreclosed lands are usually sold to private persons, they are sometimes retained as town forests, municipal watersheds, and the like. All together, the lands held by the State and local public agencies amount to only 2 percent of the total commercial forest acreage.

Most of the publicly owned forest lands lie in the three northern counties of the State (table 3). A third of the commercial forest land in Grafton County, a fourth of that in Carroll County, and nearly a fifth of that in Coos County are owned by public agencies.

TABLE 3.—*Ownership of commercial forest land in New Hampshire, by county, 1948*

County	Public			Private		
	Federal	State	Town, city, and county	Farm	Industrial and other nonfarm	Total
	Acres	*Acres*	*Acres*	*Acres*	*Acres*	*Acres*
Belknap	800	1, 900	2, 700	69, 700	131, 300	206, 400
Carroll	132, 700	5, 100	1, 300	60, 000	326, 300	525, 400
Cheshire	900	4, 300	6, 800	82, 200	295, 500	389, 700
Coos	168, 700	5, 200	4, 800	103, 000	702, 500	984, 200
Grafton	279, 000	6, 000	9, 800	199, 300	372, 300	866, 400
Hillsboro	--------	3, 100	8, 700	139, 300	291, 200	442, 300
Merrimack	3, 500	10, 200	8, 300	146, 200	312, 000	480, 200
Rockingham	--------	3, 800	4, 100	97, 800	221, 500	327, 200
Strafford	--------	200	2, 700	58, 700	117, 800	179, 400
Sullivan	--------	4, 700	3, 100	83, 300	189, 900	281, 000
Total	585, 600	44, 500	52, 300	1, 039, 500	2, 960, 300	4, 682, 200

The Forest Types

The pattern of forest types [6] in New Hampshire is rather complex. Fourteen different cover types were recognized in the forest survey. For convenience, they have been divided into four broad type groups.

The *white pine group* (fig. 9) occupies 29 percent of all the commercial forest land. It includes four forest types:

	Acres
White pine	760, 000
White pine-hardwood	331, 600
Hemlock	223, 300
Pitch pine	24, 500
Total	1, 339, 400

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[5] The White Mountain National Forest covers 651,900 acres, but 71,500 acres are classified as noncommercial forest land.

[6] A forest type is named according to the species that make up 50 percent or more of the timber stand. In sawtimber stands the percentage is based on net board-foot volume, in other stands on number of stems 1 inch or more in diameter at breast height (d. b. h.).

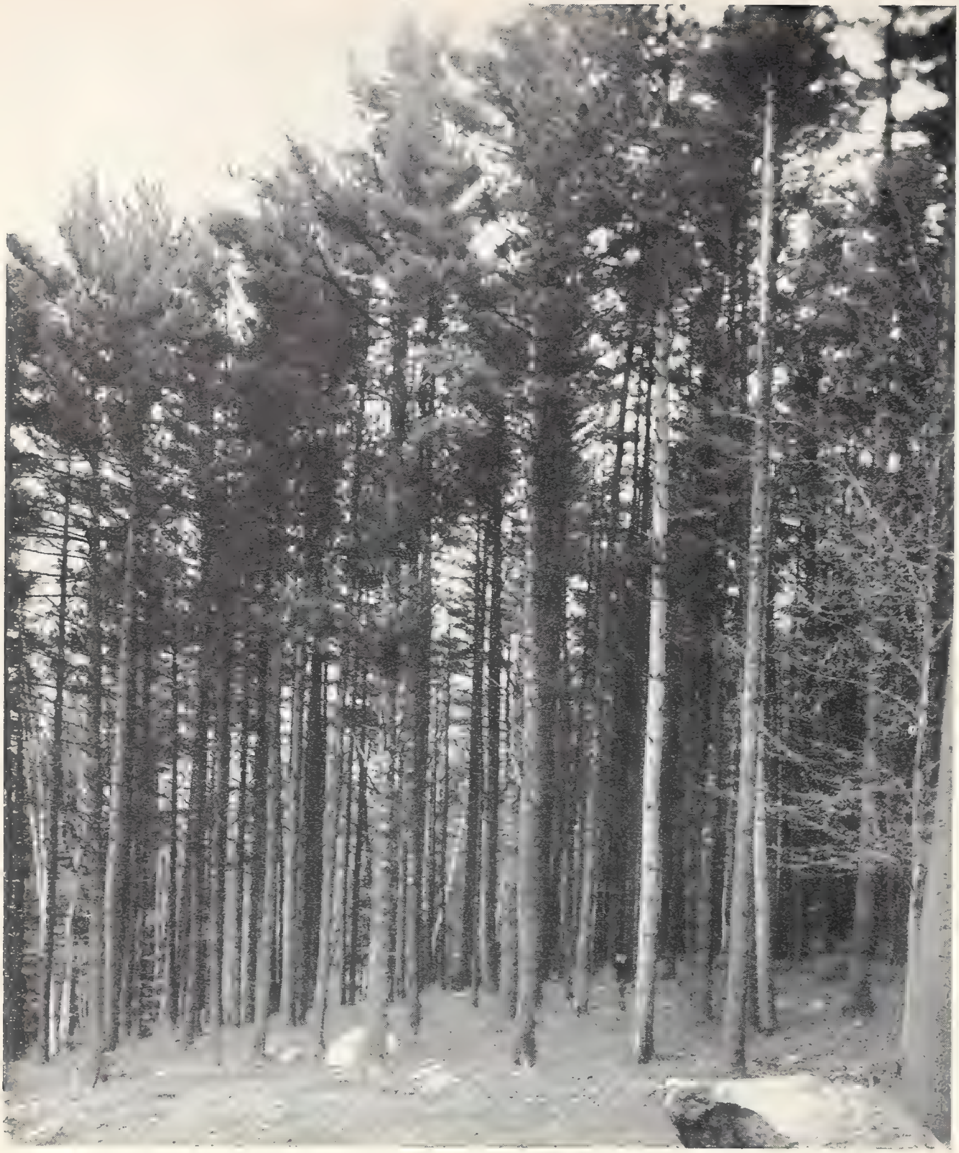

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FIGURE 9.—*The white pine forest type at its best (Belknap County). This pine stand is a rarity.*

The white pine, white pine-hardwood, and hemlock types supply most of the annual sawlog harvest.

Many of these stands occupy land that was once used for crops and pasture. As the old fields were abandoned, pure, even-aged stands of white pine took over—particularly where heavy sod or light grazing kept out the hardwoods. The pine even invaded the heavy soils that are usually thought of as hardwood sites. However, as the pine matured, the stands were cut severely. Even on the lighter soils, the cutover site conditions are seldom favorable for pine seedlings, and the hardwoods are gradually taking possession of the land.

The *spruce-fir group* (fig. 10) embraces the other important softwood types. It occupies 13 percent of the commercial forest area:

	Acres
Spruce-fir	366, 300
Spruce-fir-hardwood	207, 100
Cedar-tamarack-spruce	33, 900
Total	607, 300

These forest types make up the important pulpwood forests. They are found typically on dominant softwood sites; i. e., sites where conditions for regeneration are more favorable for softwoods than for hardwoods

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Figure 10.—*The spruce-fir forest types are the main sources of pulpwood in New Hampshire.*

(*15*). Even within the spruce-fir-hardwood type, more than 80 percent of the acreage can be classed as dominant softwood site.

While there has been some increase in the hardwood component of these types as a result of cutting, the change from spruce to fir has been even more noticeable. The common practice of cutting to a low diameter limit favors the restocking of balsam fir at the expense of spruce. As a result much of the short-lived fir is lost before the loggers return. And, since fir is more vulnerable to spruce budworm damage than spruce, the risk of losses to that insect is increased.

The *aspen-paper birch group* (fig. 11) occupies 8 percent of the commercial forest land:

	Acres
Aspen-gray birch	249, 200
Paper birch	132, 100
Total	381, 300

Both the aspen-gray birch type and the paper birch type are pioneer types that are relatively short lived. They are found most often on old burns. Where fires are excluded, the forest land eventually reverts to pine, spruce-fir, or another hardwood cover type.

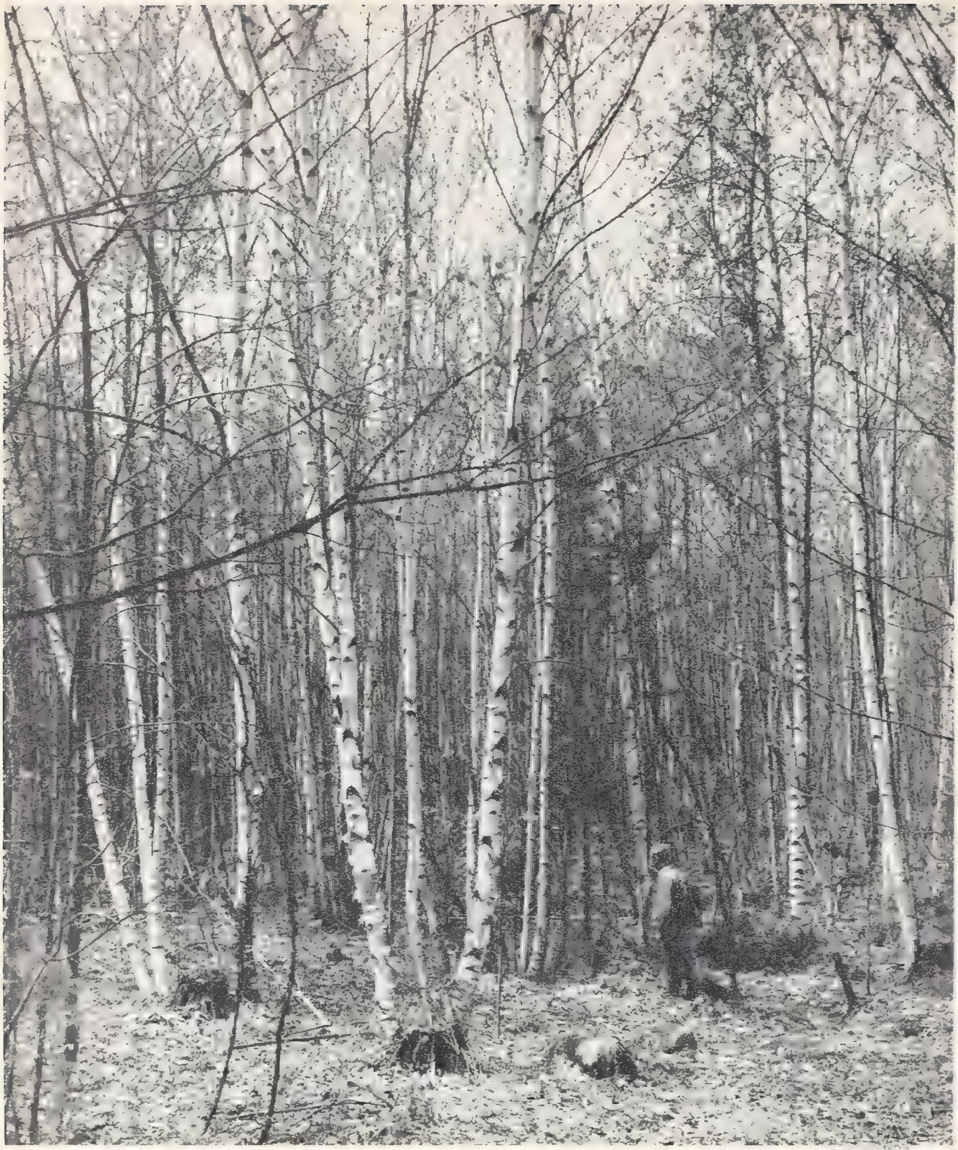

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FIGURE 11.—*The aspen-birch forest types are pioneer types that in many places come in on old burns.*

Gray birch is beneficial in that it quickly heals the scars left by fire and destructive logging. The aspen, useful for making pulp, behaves the same way. Presence of the aspen-birch type, however, indicates relatively low productive use of the land, except where it is a nurse crop for establishing more valuable trees.

Paper birch is one of the best woods in the world for turning on a lathe. Little has been known about the management of this type, but it seems likely that, with continued fire protection, paper birch acreage will dwindle unless positive measures are taken to perpetuate it.

The *hardwood type group* (fig. 12) occupies the remaining 50 percent of the commercial forest land. It includes five forest types:

	Acres
Yellow birch-sugar maple-beech	1, 230, 900
Hardwood-spruce-fir	494, 100
Hardwood-white pine	444, 500
Oak	94, 700
Ash-maple-elm	90, 000
Total	2, 354, 200

The yellow birch-sugar maple-beech type is also known as the northern hardwood type. These are the hardwoods found mostly in mixture with spruce and fir. On the other hand, the hardwoods found in mixture with the pines are usually oaks or red maple, at least in the southern counties.

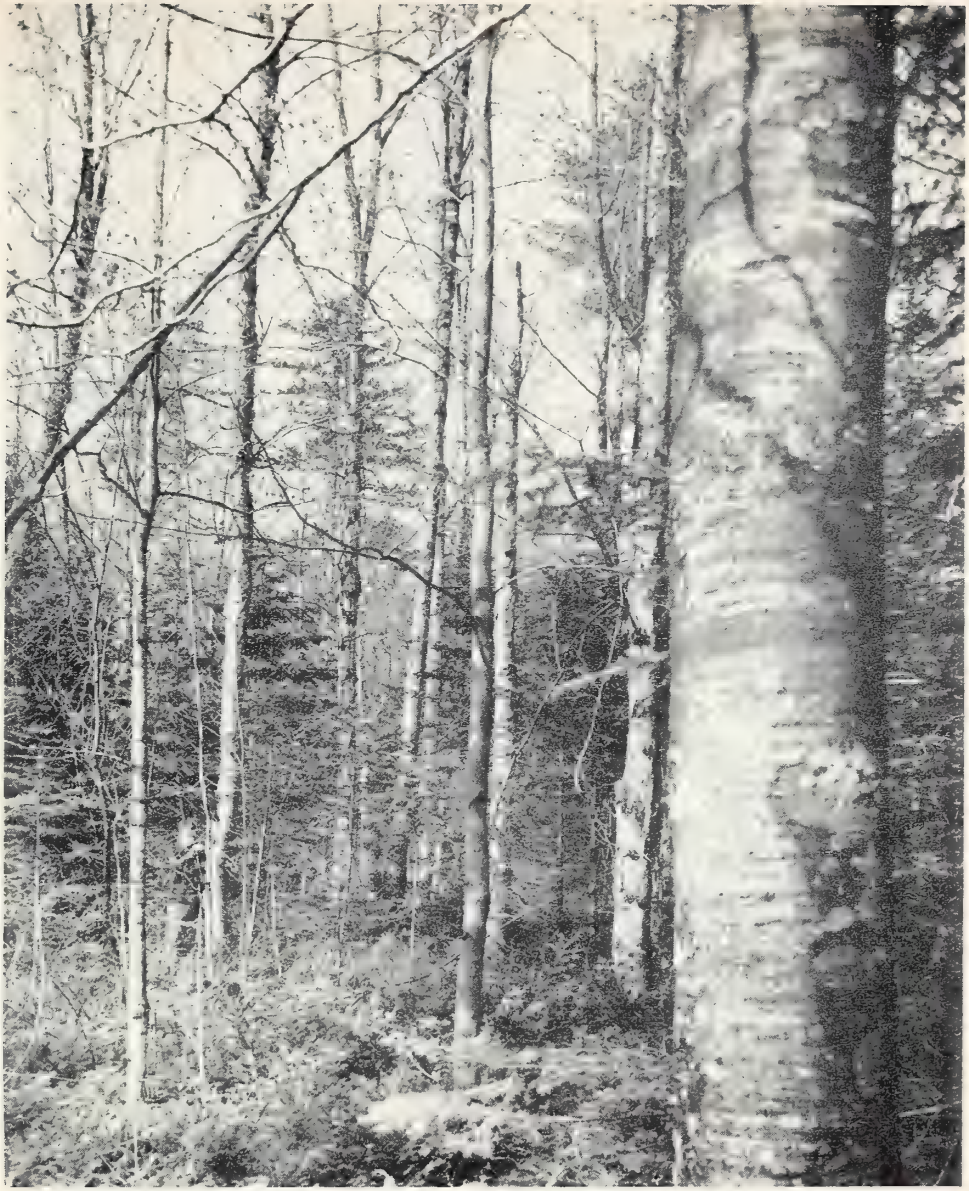

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FIGURE 12.—*Hardwood forest types now cover half of the commercial forest land, including a large acreage that was originally covered with softwoods.*

One of the major problems in these hardwood types is how to raise the quality of the growing stock. Heavy cutting of the old-growth stands often was followed by an adequate stand of well-formed saplings that had been part of the understory. However, second-growth stands frequently do not have such an understory; heavy cutting often is followed by an undesirable sprout or shrub growth.

Over the years, softwoods have been cut far more heavily than hardwoods. The hardwood invasion of softwood forests is already far advanced, and the hardwood type area is still increasing. This raises the important problem of how to select the proper species to favor in managing the present forests. Efforts to grow softwoods may prove futile in some areas; efforts to grow high-quality hardwoods may be wasted in others. More information on the relation of cover types to sites is needed.

Timber Volume

New Hampshire's commercial forest land in 1948 supported a growing stock of 3.8 billion cubic feet divided almost equally between softwoods and hardwoods. In 1952, growing stock amounted to 4.5 billion cubic feet. Hardwoods have accounted for most of the increase and now comprise about 54 percent of total growing stock. About half the softwood volume is pine, and about half the hardwood volume is in the three northern hardwoods—yellow birch, sugar maple, and beech. Distribution of the total cubic volume among species in 1948 was as follows:

	Million cubic feet
White pine	870
Spruce	354
Hemlock	325
Fir	291
Other softwoods	51
Yellow birch	413
Red maple	331
Paper birch	300
Sugar maple	299
Beech	213
Red oak	157
Ash	54
Other hardwoods	164
All species	3, 822

Sound sawlog material in 1948 accounted for 1.7 billion cubic feet, less than half of the growing stock. The other 2.1 billion cubic feet was found in poletimber trees and in the upper stems of sawtimber trees. (Table 4.)

Sawtimber Volume

Expressed in terms used by the lumberman, the sawtimber volume in 1948 was 9.7 billion board-feet.[7] Of this, 60 percent was softwood and 40 percent hardwood. White pine alone comprised one-third of the sawlog material, as the following tabulation shows:

	Sawtimber volume (million board-feet)
White pine	3, 241
Hemlock	1, 186
Other softwoods	1, 484
Yellow birch	1, 239
Sugar maple	783
Beech	526
Red oak	311
Other hardwoods	943
All species	9, 713

In 1952 the sawtimber volume reached 10 billion board-feet. In the interval 1948–52 softwood sawtimber volume decreased from 5.9 to 5.5 billion board-feet. The hardwood sawtimber volume on the other hand increased from 3.8 to 4.5 billion board-feet.

TABLE 4.—*Average net volume of live timber per acre of commerical forest land in New Hampshire, by stand-size class, 1948*

Stand-size class and acreage	Growing stock	Saw-timber
	Cubic feet	*Board-feet*
Sawtimber stands:		
More than 5,000 board-feet per acre (581,400 acres)	1, 900	7, 500
1,500 to 5,000 board-feet per acre (1,226,900 acres)	1, 100	3, 100
Poletimber stands:		
More than 600 cubic feet per acre (894,800 acres)	900	800
200–600 cubic feet per acre (841,200 acres)	400	500
Other stands (1,137,900 acres)	200	400
Average, all stands [1] (4,682,200 acres)	800	2, 100

[1] Cord volume averages about 10 cords per acre, all species.

Cord Volume

For some forest products, such as pulpwood, timber volume is measured in terms of cords. To indicate the approximate volume in cords, the total cubic growing stock has been converted to standard cords, figuring 80 cubic feet of solid wood per cord.[8]

The total growing stock in 1948 represented about 48 million cords of rough wood. The cord volume was distributed among species as follows:

	Million cords
Spruce	4
Fir	4
Hemlock	4
Pine and other softwoods	12
Yellow birch, maple, beech	15
Paper birch	4
Oak and other hardwoods	5
All species	48

Spruce and fir are still the leading pulpwood species used, but there is a growing use of hardwoods and pine. Aspen also is used chiefly for pulpwood, and paper birch bolts are the principal raw material for the wood-turning industry.

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[7] All board-foot figures in this report are based on the International ¼-inch log rule.

[8] In preliminary forest survey reports for New Hampshire, other converting factors were used: 78 cubic feet per cord for softwood and 65 cubic feet for hardwood. The new factor is one that is now widely accepted by the pulpwood industry.

Condition of the Forests

THE FORESTS of New Hampshire have worn a bit thin. You can see the evidence as you drive along highways in practically any part of the State: the poor brush and weed species growing up on land that once bore good timber; the generally small size of the trees; the thinly stocked stands; the signs of severe cutting; the many decadent trees.

Small Trees Predominate

For the State as a whole, the forest survey showed that two-thirds of the growing stock is in trees 12 inches d. b. h. or smaller (fig. 13). Because the larger trees are relatively scarce, there is great pressure for cutting these smaller trees. Yet these smaller trees are just reaching the size where they are adding board-foot volume most rapidly.

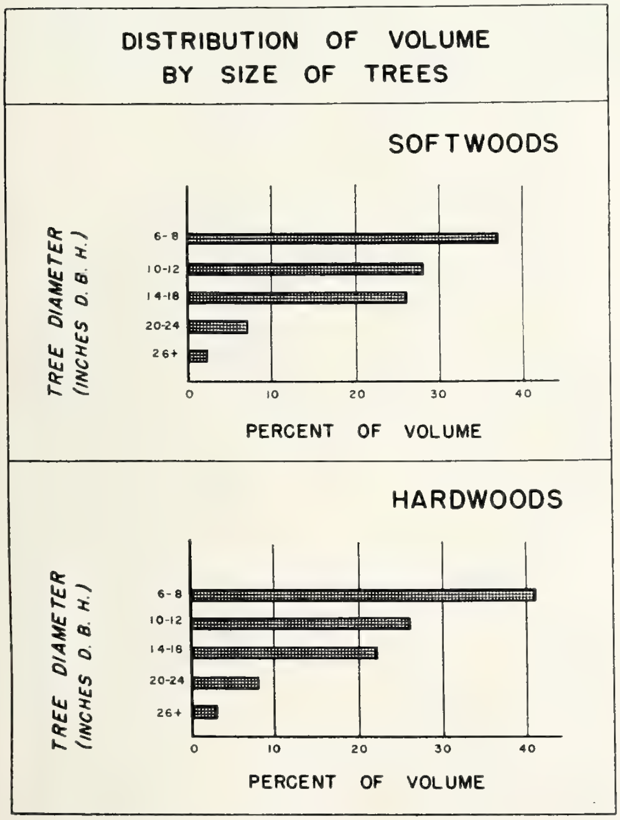

FIGURE 13.—*Small trees predominate in the forests of New Hampshire. Two-thirds of the growing stock volume is found in trees 12 inches d. b. h. and smaller.*

Stands of young timber cover 61 percent of the commercial forest land (table 5). These stands bear less than 1,500 board-feet per acre. Most of this young growth is poletimber and saplings and seedlings. This figure also includes growth on abandoned pastures, recent burns, and cutover areas where there are so few trees that they cannot be classed as forest stands at all.

The stocking of trees on the land is, for the State as a whole, only fair. Most of the land is at least 40 percent stocked; that is, at least 40 percent of the growing space is occupied by trees.

But stocking is at less than 40 percent on about 600,000 acres (fig. 14). Of this area, about one-third is stocked less than 10 percent. Most of the other two-thirds is occupied by sparse seedling-and-sapling stands. Half of this acreage could be planted. Some will regenerate naturally. And some sparse stands will eventually become stands with closed canopies, but the trees will be poorly formed and will have large, limby crowns.

The greatest problem of regeneration is in the aspen-birch and white pine types. More than one-third of the aspen-birch type group is poorly stocked (less than

TABLE 5.—*Commercial forest-land area of New Hampshire, by county and stand-size class, 1948*

County	Stand-size class			All classes
	Saw-timber	Pole-timber	Other	
	Acres	*Acres*	*Acres*	*Acres*
Belknap	92, 300	46, 500	67, 600	206, 400
Carroll	315, 800	138, 000	71, 600	525, 400
Cheshire	115, 100	158, 500	116, 100	389, 700
Coos	426, 700	372, 000	185, 500	984, 200
Grafton	296, 100	394, 300	176, 000	866, 400
Hillsboro	135, 600	154, 100	152, 600	442, 300
Merrimack	198, 900	144, 700	136, 600	480, 200
Rockingham	95, 300	123, 900	108, 000	327, 200
Strafford	41, 900	75, 700	61, 800	179, 400
Sullivan	90, 600	128, 300	62, 100	281, 000
Total	1, 808, 300	1, 736, 000	1, 137, 900	4, 682, 200

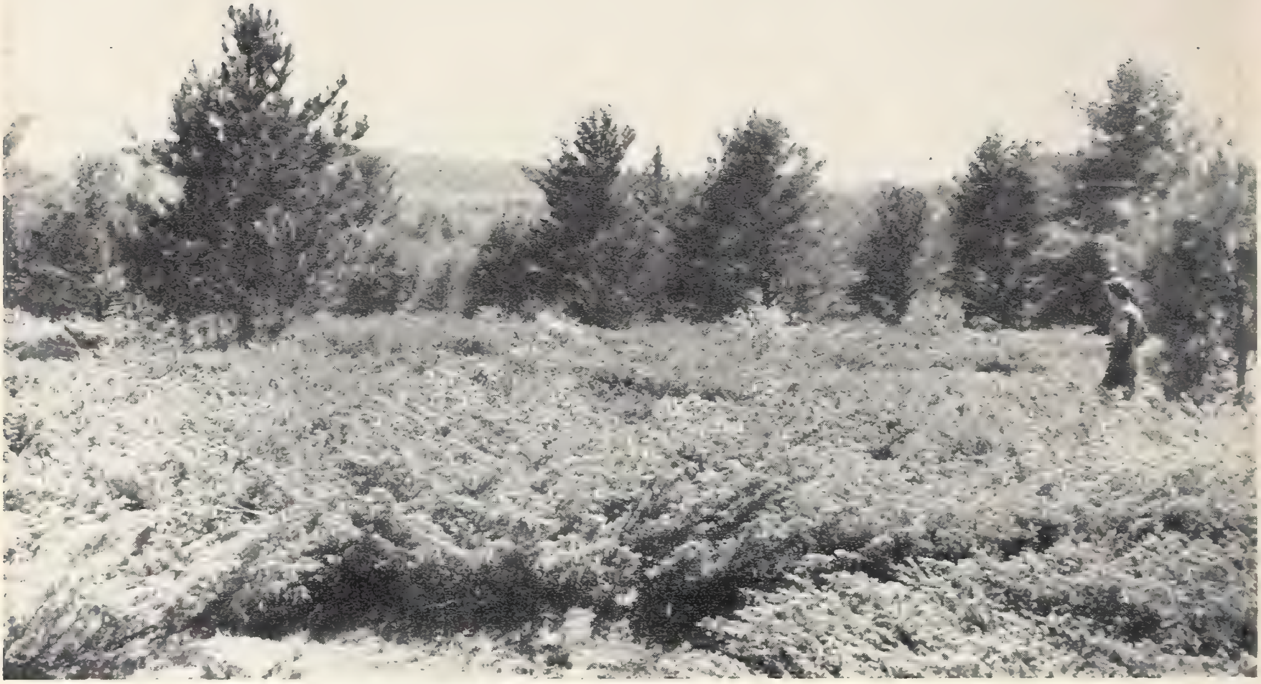
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FIGURE 14.—*About 600,000 acres of forest land in New Hampshire are understocked.*

40 percent). Although only 13 percent of the white pine area is poorly stocked, it seems likely that the percentage would be much higher were it not for the rapid invasion of hardwoods on lands where pine has been removed. The spruce-fir type is generally well stocked.

About 12 percent of the hardwood areas are poorly stocked. But since most hardwoods sprout readily, very little of the hardwood area is nonstocked.

Distribution of Sawtimber

Only about 13 percent of the commercial forest land in the State is occupied by medium and heavy stands of sawtimber. These are the stands that bear 5,000 or more board-feet per acre. They average 7,500 board-feet per acre. Light stands of sawtimber occupy about 26 percent of the forest land. These stands bear 1,500 to 5,000 board-feet per acre.

The heavier sawtimber stands are more prominent among the softwood types. This is partly because the commercially acceptable diameter limits for softwood sawtimber are lower than for hardwood. Also, less cull is found in softwood trees. Many of the hardwood sawtimber stands are made up of overmature trees that were left after the softwoods had been removed.

In all forest types, sawtimber volume is concentrated on relatively small acreages. For example, the hardwood types occupy 2.4 million acres and in 1948 contained 4.4 billion board-feet; but nearly one-half this volume was found on one-tenth of the acreage—in the heavier sawtimber stands.

Part of the sawtimber volume is scattered through stands of poletimber and stands of saplings and seedlings. In the same way, nearly half of the poletimber volume is scattered through sawtimber stands. Such distribution provides excellent opportunities for forest management. Light harvest cuttings or improvement cuttings can be made now. The young trees left to grow ensure another harvest in the not-too-distant future.

Quality

A sawtimber stand may contain a large wood volume in cubic feet, yet may not contain even one high-grade log per acre. All the trees may be too small or limby to yield anything but the poorest grade of lumber. Even the most efficient mills cannot run indefinitely on such material.

To measure the quality of New Hampshire's sawtimber a special survey was made in 1952. Logs in hardwood and white pine sample trees were classified log by log.[9] Hemlock sample trees were classified according to the limbiness of the sawlog part of their stems. Other softwoods were not graded.

The hardwood log grades used in this survey are based on number of potential clear cuttings in standard lumber logs and on structural usefulness in tie and timber logs. When standard lumber logs are sawed, the yield of No. 1 Common and Better standard lumber is about two-thirds of Grade 1 log volume, about half of Grade 2 log volume, and about one-fifth of Grade 3 log volume. These hardwood log grades were developed by the U. S. Forest Service's Forest Products Laboratory.

The white pine log grades are based on knottiness of yard lumber logs. They are the same grades that were applied to the huge volume of white pine logs salvaged after the New England hurricane of 1938. At that time the average Grade 2 or better log sawed out 10 to 30 percent in No. 1 Common and Better lumber or 25 to 50 percent in No. 2 Common and Better lumber. Corresponding lumber-grade yields were considerably lower for Grade 3 logs.

Of the total hardwood sawtimber volume in 1948, it is estimated that about 36 percent was suitable for conversion into Grade 1 or Grade 2 standard lumber logs:

	Total sawtimber volume (million bd.-ft.)	*Standard lumber logs— Grade 1 and 2 (million bd.-ft.)*	*Other logs (million bd.-ft.)*
Yellow birch	1,239	644	595
Sugar maple	783	211	572
Beech	526	137	389
Oak	349	105	244
Other hardwoods	905	253	652
All hardwoods	3,802	1,350	2,452

The other 64 percent of the hardwood sawtimber volume was of poorer quality, suitable for Grade 3 standard lumber logs or for tie and timber logs, but not for Grade 1 or Grade 2 standard lumber logs (fig. 15).

Of the 3,241 million board-feet of white pine in 1948, about 551 million board-feet (17 percent) was suitable for felling and bucking into Grade 2 or better logs. The other 2,690 million board-feet (83 percent) would not make better than Grade 3 logs.

About one-third of the 1,186 million board-feet of hemlock sawtimber was found in relatively smooth trees. These are trees where the sawlog part of the stem is 80 percent or more clear of limbs. The other two-thirds of the hemlock sawtimber was found in limbier trees.

These estimates indicate the rather low quality of New Hampshire timber. Undoubtedly many of the poorest sawtimber trees must be removed if growing space is to be made available for the better trees. Present local markets are inadequate to handle more than a small fraction of the lower grade logs that improvement cuttings might supply. Either greater markets or heavier investments by owners for girdling and poisoning are needed if the stands are to be improved.

However, it should be recognized that part of the low-quality problem is size. New Hampshire's sawtimber is small; small logs rate a lower grade than large logs, even if they show no more surface defects. Leaving the better trees to grow will help to raise the general level of log quality.

Cull

Besides the volumes of growing stock already mentioned, there are nearly 600 million cubic feet of sound wood in cull trees. This additional material is equal to 15 percent of the growing stock.

	Softwood (million cu. ft.)	*Hardwood (million cu. ft.)*	*Total (million cu. ft.)*
Sound cull trees	148	118	266
Rotten cull trees	26	299	325
Total	174	417	591

In addition to cull tree volume there is also a sizable volume of defective material in the sawtimber trees themselves. Of the gross volume of softwood sawtimber trees (in terms of the International ¼-inch rule to a 6-inch top), 14 percent has been deducted for defect to arrive at net volume. This deduction for

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[9] The New Hampshire Extension Service helped greatly in gathering this data. Most of the measurements were taken by county foresters.

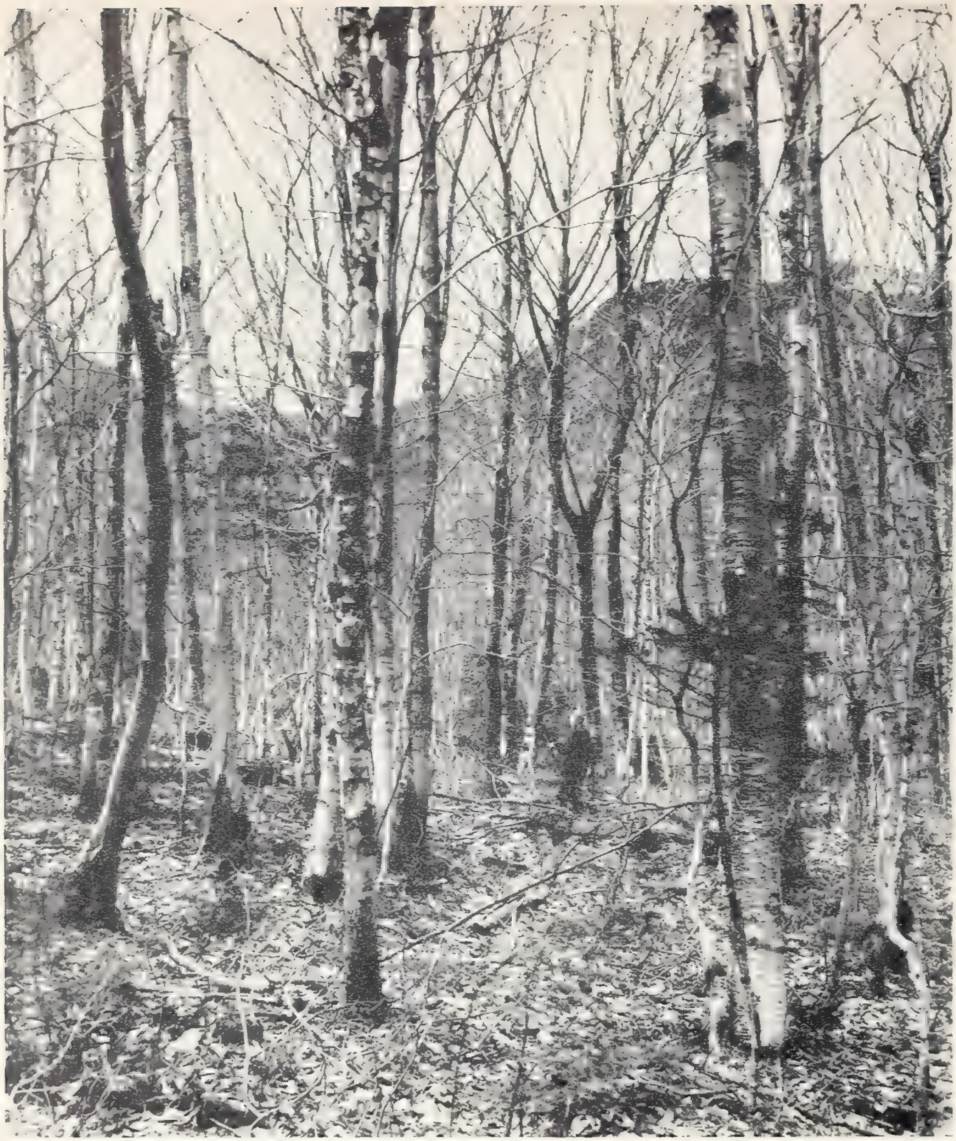

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FIGURE 15.—*Quality is a serious problem, especially with the hardwoods. Unless cull trees are removed, stands like this will not produce much high-quality sawtimber.*

defect was 12 percent for white pine, 20 percent for spruce, and 17 percent for hemlock.

In hardwood sawtimber trees, the deduction for defect (in terms of the International ¼-inch log rule to an 8-inch top) amounted to 14 percent. For the major species, the following deductions were made to arrive at net sawtimber volume:

	Deduction for defect (percent)
Sugar maple	13
Red maple	15
Red oak	11
Yellow birch	12
Paper birch	18
Beech	25
Ash	13

The problem for forest owners is how to clear the forest of cull trees. Cull trees, particularly those of sawtimber size, occupy growing space, crowd good trees, and suppress small trees.

Improvement cutting or measures such as girdling or poisoning are needed. These measures require cash outlays unless enough cull tree material can be marketed to cover the immediate costs of conditioning the stand. Statewide, a big job of cleaning up the forest remains to be done.

Species Composition

Trees of any one species are often found scattered among stands of other species. Of course this species composition is no problem for the logger who integrates his operation to cut a variety of species and produce a variety of products. However, to the logger who depends on a particular species for a particular product, species composition is important.

Paper birch is an example. Much of it grows scattered through other forest types such as yellow birch-sugar maple-beech or spruce-fir-hardwood. Another example is white pine. Of the total volume of white pine sawtimber, less than 2.3 billion board-feet was found in sawtimber stands where white pine is a major component. The other half billion board-feet was scattered through spruce-fir and hardwood forest types.

Total Versus Available Timber Volume

Not all of the timber volume in New Hampshire is actually available for use. In dealing with this timber, one must consider the practical problem of harvesting it. How much is operable?

The problem of operability lies in the location and character of the forest stands and logging conditions. The logger faces the question whether he can log a stand profitably. He has to consider species composition, volume of timber per acre, tree size, tree quality, and markets. These are generally more important than gross volume alone.

If sawtimber trees are scattered thinly through stands of small growth, they may not be worth going after for sawlogs unless the logger can integrate sawlog harvesting with logging of cordwood products. Pulpwood loggers are not likely to be interested in cutting the pulpwood volume in light poletimber and seedling-and-sapling stands.

No rigid line can be drawn between operable and unoperable stands. However, in the survey 1,500 board-feet per acre was taken as minimum for sawtimber stands. On this basis, the survey showed that there are 8.1 billion board-feet of sawtimber in sawtimber stands. The other 1.6 billion board-feet of sawtimber is in lighter stands.

Balancing the Timber Budget

TO MANAGE any business in an orderly way, one must find some sort of balance between income and outgo. With a forest resource, the growth must be balanced against the timber cut. And losses by fire, storm, insects, and diseases must be taken into account.

To find out how well the timber budget is balanced in New Hampshire, estimates of growth and timber cut were made. Since no previous survey plots were available for remeasuring, the estimates of growth were based on increment borings of living trees. These estimates are tentative.

Estimates of Growth

Three elements of net annual growth were estimated: (1) The annual increase in net volume of the trees that make up the growing stock at the beginning of the year; (2) the ingrowth—that is, the volume of saplings that grow to pole size (5.0 inches d. b. h.) during the year and thus become part of the growing stock; (3) a deduction for the volume lost by mortality during the year.

The growth of cull trees and the increase in limbwood volume were ignored. Except for ingrowth, the growth of seedlings and saplings was not counted. Tree mortality was estimated from examination of trees already dead when the plot was measured. It is admittedly the weakest part of the growth estimate.

The net annual growth of the forest growing stock in New Hampshire in 1948 was estimated at 187 million cubic feet (table 6). This is about 2.3 million cords. By 1952 the net annual growth of growing stock had increased to an estimated 212 million cubic feet (table 7).

Of course most of this volume was growth on the initial growing stock. But ingrowth is an important item: more than one-fourth of the total growth was ingrowth. Hardwoods accounted for 57 percent of the net growth in 1948. In 1952 the hardwood net growth was estimated at 62 percent of the total.

The net annual growth of sawtimber in 1948 amounted to 456 million board-feet—just short of 100 board-feet per acre of commercial forest land. Ingrowth—the volume of poletimber trees that grow to sawtimber size during the year—was nearly two-fifths of the total. Although the net growth of softwood sawtimber has decreased, the increased growth of hardwood has more than offset this. The total net annual growth of sawtimber in 1952 was 472 million board-feet, 55 percent softwood and 45 percent hardwood (table 7).

The distribution of the net annual cubic-foot growth among species was as follows in 1948: spruce and fir of all sizes, 15 percent; white pine sawtimber trees,

TABLE 6.—*Components of net annual growth on commercial forest land of New Hampshire, by species group, 1948*

Item	Softwoods	Hardwoods	All species
	Thousand cubic feet	*Thousand cubic feet*	*Thousand cubic feet*
Growth on initial growing stock	67, 800	77, 600	145, 400
Ingrowth (saplings that become poletimber)	17, 500	34, 700	52, 200
Total	85, 300	112, 300	197, 600
Mortality	4, 800	5, 500	10, 300
Net annual growth	80, 500	106, 800	187, 300

TABLE 7.—*Net annual growth on commercial forest land of New Hampshire, by tree-size class and species group, 1952*

Tree-size class and species group	Sawtimber	Growing stock
	Thousand board-feet	*Thousand cubic feet*
Sawtimber trees:		
Softwood	259, 000	53, 000
Hardwood	213, 000	56, 000
Total	472, 000	109, 000
Poletimber trees: [1]		
Softwood		27, 000
Hardwood		76, 000
Total		103, 000
Sawtimber and poletimber trees:		
Softwood	259, 000	80, 000
Hardwood	213, 000	132, 000
Total	472, 000	212, 000

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[1] Softwood trees 10 inches d. b. h. are classed as sawtimber trees; hardwood trees of this diameter are classed as poletimber trees. Ingrowth of sawtimber trees, of course, is a deduction from growth of poletimber trees.

15 percent; white pine poletimber trees and all other softwoods of all sizes, 13 percent; red maple, 12 percent; sugar maple, 11 percent; yellow birch, 9 percent; paper birch, 7 percent; beech, 7 percent; and other hardwoods, 11 percent.

Timber Cut

Timber cut is the volume removed by harvest of timber products for sale and for home use. It includes logging residues and growing stock that is knocked down or otherwise destroyed in logging as well as in the output of timber products.

The annual cut of growing stock was estimated at 98 million cubic feet in 1952 (table 8)—three-fourths softwood and one-fourth hardwood. In terms of sawtimber, the cut was 343 million board-feet—four-fifths softwood and one-fifth hardwood.

TABLE 8.—*Timber cut on commercial forest land of New Hampshire, by tree-size class and species group, 1952*

Tree-size class and species group	Sawtimber	Growing stock
Sawtimber trees:	*Thousand board-feet*	*Thousand cubic feet*
Softwood	274, 093	64, 120
Hardwood	69, 245	14, 894
Total	343, 338	79, 014
Poletimber trees:[1]		
Softwood		10, 397
Hardwood		8, 869
Total		19, 266
Sawtimber and poletimber trees:		
Softwood	274, 093	74, 517
Hardwood	69, 245	23, 763
Total	343, 338	98, 280

[1] Hardwood poletimber trees include the 10-inch diameter class; softwood poletimber trees do not.

About 50 percent of the total growing stock cut was pine, 15 percent spruce and fir, and 10 percent hemlock. Only 25 percent of the annual cut of growing stock was hardwood. Yellow birch, beech, and hard maple accounted for 16 percent. The remainder, or 9 percent, consisted chiefly of oak, and such soft hardwoods as white birch, red maple, and aspen.

Timber cut since 1947 has been at about the 1952 rate. However, there has been a slight but steady increase in timber cut for veneer, cooperage, and pulpwood, and an offsetting decline in growing stock cut for fuelwood.

Sawlogs for lumber are by far the most important product cut in New Hampshire. In 1952 sawlogs accounted for two-thirds of the total annual cut of growing stock. About 90 percent of the sawlog cut comes from sawtimber trees, and the balance from poletimber, cull, and dead trees.

About 87 percent of timber cut for sawlogs is softwood. Pulpwood comprises 20 percent of the total timber cut and likewise consists largely of softwood.

	Percent of total timber cut	*Softwood (percent)*
Sawlogs	66	87
Pulpwood	20	68
Fuelwood	7	11
Other products	7	48
	100	

Relationship of Growth to Timber Cut

All in all, net growth exceeds the annual cut in New Hampshire (table 23, appendix). Comparing net growth with annual cut, one might conclude that all is well with the forests of New Hampshire. It is not. Any comparison of this sort is misleading.

Even though growth exceeds annual cut, a large part of New Hampshire's forest land is actually growing trees at a rate below its timber-producing capacity. Also, growth-cut comparisons are deceiving unless you look at differences in quality and species. When the principal demand is for softwood sawtimber, a large excess of growth in small hardwood trees is not very helpful. This is the situation that now prevails in New Hampshire.

For hardwood sawtimber the growth-cut ratio in 1952 was favorable (fig. 16). The hardwood saw-

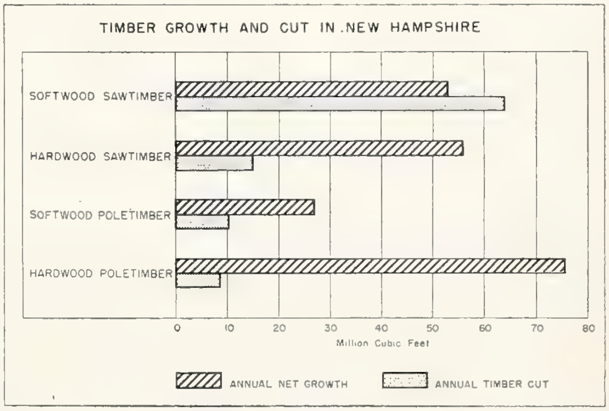

FIGURE 16.—*The relationship of growth to annual cut of growing stock. Softwoods are being cut harder than they can long endure. Unused volume is piling up in the hardwoods.*

timber growing stock was being added to every year, not only from the excess of growth over cut but also from the ingrowth of hardwood poletimber.

All the hardwood species, with the possible exception of paper birch and red oak, are being cut at a rate that is undoubtedly well below the current growth rate. Only 14 percent of net annual growth of red maple is being cut annually. Since this is one of the less desirable species, it is often left in the woods to compete with better species for the growing space.

Whereas annual net growth and timber cut of softwood growing stock is essentially in balance, the cut of softwood sawtimber is in excess of net growth by about 11 million cubic feet, or more than 20 percent. The softwood sawtimber stands certainly cannot sustain this rate of cutting for very long.

The cutting of hardwoods principally for veneer and pulpwood has increased in recent years. This trend, if continued, could conceivably result in less serious overcutting of softwoods.

The Problem—And What Should Be Done

NEW HAMPSHIRE is one of the most extensively forested States. Its economy is dependent, to a considerable degree, upon the condition of the forest resource. About one-fifth of its employment, and about one-sixth of its income, can be attributed to timber-based business.

The forest problem in New Hampshire can be traced to four current conditions:

1. Throughout the State, the forest stands are predominantly young. Softwood stands in particular are cut so heavily that few trees are allowed to grow to economic maturity.

2. The hardwoods, cut less heavily, tend to occupy more and more growing space on the forest lands everywhere in the State. The proportion of hardwoods in the growing stock is increasing. Young hardwood stands are well established, and seed-bearing cull hardwoods are distributed widely. The conditions that helped softwoods to invade abandoned fields and pastures no longer exist. Maintaining softwoods on many sites is acknowledged to be not economically practical.

3. The standing volume in cull hardwood trees and in sawtimber trees of relatively low quality presents a formidable obstacle to good silviculture.

4. Sawlog timber that meets the quality requirements of New Hampshire industries has been harvested in recent years faster than it is growing. Operable and accessible stands of good-quality white pine especially are not being replaced fast enough to sustain the present rate of cutting. On the other hand, the volume of timber that is suitable only for pulpwood, fuelwood, and other less demanding uses is increasing faster than it is being cut.

Where overall growth exceeds the timber cut, as it does in New Hampshire, there is an opportunity to rebuild the forest resources. This rebuilding can come only from intensified and continuous research and from improved management and utilization practices. Available information already points to numerous opportunities for developing and using New Hampshire's forest resource.

The coming predominance of hardwoods need not be regarded entirely with dismay. Conversion of forest industry to hardwood utilization has already started. This trend can be accelerated. Climate, soil, and nearness to markets give New Hampshire excellent prospects for producing quality hardwoods not only for local use but for use throughout the industrial Northeast. Measures recommended as the initial steps toward solving the forest problems of New Hampshire follow.

Improve Cutting Practices

Better cutting practice is the key to better production from the remaining stands of sawtimber. Although sawtimber stands occupy less than 40 percent of the commercial forest land, they carry 84 percent of the sawtimber volume. Here is the wood supply for the present. Here, also, lies the greatest opportunity for quick results from modern forest-management methods.

If these sawtimber stands are cut in accordance with good silviculture, it is possible to shift growth from low-quality to high-quality trees. A forester's help is needed to mark the trees to be cut or left. The State's county foresters, supported cooperatively by the State and Federal Governments under the Cooperative Forest Management Act of 1950, are available to small-forest owners to advise about cutting practices and to mark the trees to be cut. Or owners may employ a consulting forester to supervise the entire job from marking to marketing. Private forestry organizations are also available to serve the small owner. Among them are the Society for the Protection of New Hampshire Forests and the New England Forestry Foundation.

Owners who cut so as to leave the land in possession of desirable species for vigorous or high-quality growth meet one of the major requirements for tax abatement under the New Hampshire act relating to forest conservation and taxation (ch. 295, Laws of 1949). District forest advisory boards recommend, and the Forestry and Recreation Commission approves, the particular cutting-practice standards that qualify for tax abatement.

When a sawtimber stand is cut in accordance with good silviculture, seedlings usually get started without difficulty. With some sites and cover types, however, reinforcement planting or seedbed-preparation measures may be required to obtain a moderate restocking of the more desirable species, particularly pine and spruce.

Improvement cuttings and thinnings are needed in all stands, especially at the beginning of a management program. Almost all of the present stands are characterized by cull trees left standing after previous logging operations. Early removal of these culls will often speed up growth of the better trees and make space available for the growing stock.

Poletimber and seedling-and-sapling stands occupy 61 percent of the commercial forest land. These are the merchantable stands of the future. Action is needed now to make sure that the yield from these stands will meet future requirements.

Without widespread acceptance of better cutting practices, the greatest hazard to poletimber stands is premature cutting for box logs and for pulpwood and other cordwood products. It is to the mutual benefit of both the forest owner and the forest industry to protect such stands from unwise harvesting just as they are entering their period of most profitable growth.

To avoid premature harvesting, however, does not mean to avoid all cutting. Other kinds of cutting—thinning and liberation cutting—are needed. In older poletimber stands, such practices will often pay for themselves. But, more important, they serve to concentrate growth on fewer and better trees, thus bringing them to merchantable size more quickly. Reinforcement planting may be necessary where softwood composition is inadequate.

Protect the Forest Resource

Cooperative measures for protecting forests against fire, insects, and disease might be intensified. Particular attention might be given to controlling destructive forest insects, such as the spruce budworm, and to preventing further losses from white pine blister rust.

During the budworm epidemic of 1910–19 New Hampshire's losses, though never estimated, were severe. There are indications that vulnerability to budworm epidemics can be reduced through forest-management measures. These are a system of permanent roads that will make accessible most of the spruce-fir forests, and shorter cutting cycles—20 years or less in most instances—to provide more vigorous and resistant stands through partial cutting and early removal of mature fir.

The white pine weevil is probably more destructive in the long run than the budworm. When weevil grubs kill the terminal leader of a young white pine, the live branches in the next lower whorl grow upward. The tree thus becomes forked or crooked, of poor form for sawlogs. Downgrading of timber as a result of weeviling can be minimized by growing white pine in pine-hardwood mixtures, keeping the young pine under the protection of larger hardwoods until it is one or two logs tall. Pure pine stands, if kept densely stocked, will be weeviled, but there will be some straight trees for the final crop.

Control of white pine blister rust has a long history in practice. The rust spreads only where pine and Ribes species (currants and gooseberries) are both present. It is controlled by eradicating the Ribes plants. Continued Federal, State, and town cooperation is needed to keep blister-rust losses under control.

New England's beech is threatened by a bark fungus (Nectria) that attacks trees in combination with an insect (the beech scale). The insect by itself does little damage. Nor is the fungus known to be a serious pest except when associated with heavy infestations of the insect. It is thought, at present, that best control is obtained by measures that keep beech fast growing and thrifty. Earlier removal of beech from mixed hardwood stands will not only improve species composition but may also help to reduce the damage from these pests.

Birch dieback has caused much concern among foresters and hardwood users for many years. The causes of the condition are still unknown. The bronze birch borer is usually present in affected trees. Owners of birch timberland may reduce their losses by using short cutting cycles to hasten removal of affected trees and to encourage growth and seed production by the more vigorous individuals.

Encourage Adjustments in Timber Utilization

Forest industry in New Hampshire has been traditionally dependent upon the softwood species. This dependence can be seen in the distribution of the forest industries. Many sawmills are trying to get along with scarce pine stumpage in the southern counties. Few sawmills are found in the northern counties where the hardwood timber is concentrated.

A shift of forest industry is needed from south to north, and particularly from softwood to hardwood. Such a shift would help to stretch the timber supply, and growing stock would have an opportunity to build up.

The major utilization problem is to find uses for low-grade hardwoods. The box industry has provided an outlet for inferior pine logs for many years; a similar hardwood outlet is needed. The use of cull hardwoods for pulp, fuel, charcoal, and other uses might be increased. Intensified research will help here. Expansion of the industries already in these fields should be encouraged.

Almost one-tenth of the annual cut of growing stock is left in the woods as logging residue. This is partly the result of having many trees of poor form; the bulk of the residue is in upper stems too rough for sawlogs. But partly too it is the result of wasteful logging methods. Logging residue can be reduced through integrated logging. And it would help if loggers were shown how to obtain the highest grade in bucking logs.

In the sawmills, sawing techniques can be improved, particularly at the small portable mills. Better sawing, seasoning, and grading at hardwood sawmills would lead to better products and wider markets. At present there are numerous opportunities in lumber markets if the quality of the product can be controlled and improved.

Develop Better Marketing Procedures

With few exceptions, the producer of forest products is not very responsive to consumer preferences. Failure to recognize log and lumber grades, poor manufacturing, and haphazard marketing are evidence of this deficiency.

Timber from the typical small forest is sold about once each generation. Often the owner does not even know how much timber he owns and so is inclined to sell for a lump sum. Then his lot is stripped and he promptly loses interest in it. The stumpage is rarely marketed for more than one kind of product and many trees therefore are not sold for their highest use. As a result, income is frequently lower than it should be.

More information about potential forest values and current log and stumpage prices would help increase owner interest in forestry. The periodic market reports prepared by the Extension Forester are helpful. Written sale contracts between owners and loggers would help the owner receive full value for his timber and insure that logging conforms to the owner's wishes.

Good marketing practice means adequate knowledge of markets and prices, use of standard grades, continuous search for outlets for wood of marginal quality, and knowledge of the volume and specifications of the trees or products offered for sale.

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Appendix

Definition of Terms

Forest Area

Forest-land area.—Includes (*a*) lands that are at least 10 percent stocked by trees of any size and capable of producing timber or other wood products, or of exerting an influence on the climate or on the water regime; (*b*) land from which the trees described in (*a*) have been removed to less than 10-percent stocking and that has not been developed for other use; and (*c*) afforested areas. (Forest tracts of less than 1 acre and isolated strips of timber less than 120 feet wide are excluded.)

Commercial forest-land area.—Forest land that is (*a*) producing, or physically capable of producing, usable crops of wood (usually sawtimber), (*b*) economically available now or prospectively, and (*c*) not withdrawn from timber utilization.

Noncommercial forest-land area.—Forest land (*a*) withdrawn from timber utilization through statute, ordinance, or administrative order, but that otherwise qualifies as commercial forest land, or (*b*) incapable of yielding usable wood products (usually sawtimber) because of adverse site conditions, or so physically inaccessible as to be unavailable economically in the foreseeable future.

Forest Types

Forest types are defined according to the species, or species group, that makes up the major part of the stand in terms of board-feet in sawtimber stands or number of stems in other stands.

White pine type group.—The principal types included are white pine (white pine making up 75 percent or more of the stand), hemlock (hemlock pure or predominant over any single associate), and white pine-hardwood (white pine making up 50 to 74 percent of the stand). Stands in which pitch pine makes up 75 percent or more of the stand also are included in this type group.

In table 17, these four types are grouped as the *white-red-jack pine forest type,* which is defined as follows: Forests in which 50 percent or more of the stand is eastern white pine, or jack pine, singly or in combination. (Common associates include hemlock, aspen, birch, and maple.)

Spruce-fir type group.—Spruce and balsam fir make up 75 percent of the spruce-fir stands and 50 to 74 percent of the spruce-fir-hardwood stands. The cedar-tamarack-spruce type is also included in this group.

In table 17, these three types are grouped as the *spruce-fir forest type:* Forests in which 50 percent or more of the stand is spruce or true firs, singly or in combination. (Common associates include white-cedar, tamarack, birch, and hemlock.)

Aspen-paper birch type group.—Pure stands of aspen, gray birch, or paper birch, or stands in which these species predominate.

In table 17, the two types in this group comprise the *aspen-birch forest type:* Forests in which 50 percent or more of the stand is aspen, balsam poplar, paper birch or gray birch, singly or in combination. (Common associates include maple and balsam fir.)

Hardwood type group.—The northern hardwood type, largely yellow birch, sugar maple, and beech, is the principal type in this large group. Next in importance is the hardwood-spruce-fir type, in which spruce and fir make up 20 to 49 percent of the stand in mixture with hardwoods. The hardwood-white pine, ash-maple-elm, and oak types also are included.

In table 17, these 5 types are grouped as 3 types. The yellow birch-sugar maple-beech type, the hardwood-spruce-fir type, and the hardwood-white pine type are all included in the *maple-birch-beech forest type:* Forests in which 50 percent or more of the stand is maple, beech, or yellow birch, singly or in combination. (Common associates include hemlock, elm, basswood, and white pine.)

The ash-maple-elm type appears in table 17 as the *elm-ash-cottonwood forest type:* Forests in which 50 percent or more of the stand is elm, ash, or cottonwood, singly or in combination. (Common associates include willow, sycamore, beech, and maple.)

The oak type is listed in table 17 as the *oak-hickory forest type:* Forests in which 50 percent or more of the stand is upland oaks or hickory, singly or in combination, except where pines comprise 25 to 49 percent, in which case the stand would be classified "oak-pine." (Common associates include yellow-poplar, elm, maple, and black walnut.)

Diameter Classes

Two-inch tree diameter classes were used. For example, the 10-inch class includes trees 9.0 to 10.9 inches. Diameter is measured outside bark at a point 4½ feet above the ground (d. b. h.)

Tree Classes

SAWTIMBER TREES.—Trees of commercial species that contain at least one merchantable sawlog as defined by regional practice and that are of the following minimum diameters at breast height (d. b. h.): Softwoods 9 inches and hardwoods 11 inches. (Merchantable sawlogs must be at least 8 feet long, and not less than 6 inches in diameter if softwood or not less than 8 inches in diameter if hardwood.)

POLETIMBER TREES.—Trees of commercial species that meet regional specifications of soundness and form, and are of the following diameters at breast height: softwoods 5 to 9 inches; hardwoods 5 to 11 inches. (Such trees will usually become sawtimber trees if left to grow.)

SEEDLING-AND-SAPLING TREES.—Live trees of commercial species less than 5 inches in diameter at breast height and of good form and vigor.

CULL TREES.—Live trees of sawtimber or poletimber size that are unmerchantable for sawlogs now or prospectively because of defect, rot, or species.

Stand-size Classes

SAWTIMBER STANDS.—Stands with sawtimber trees having a minimum net volume per acre of 1,500 board-feet, International ¼-inch rule.

POLETIMBER STANDS.—Stands failing to meet the sawtimber stand specification, but at least 10 percent stocked with poletimber and larger trees, and with at least half of the minimum stocking in poletimber trees.

SEEDLING-AND-SAPLING STANDS.—Stands not qualifying as either sawtimber or poletimber stands, but having at least 10-percent stocking of trees of commercial species, and with at least half the minimum stocking in seedling-and-sapling trees.

STOCKING.—Stocking is the extent to which growing space is effectively utilized by present or potential growing stock trees of commercial species. "Degree of stocking" is synonymous with "percent of growing space occupied" and means the ratio of actual stocking to full stocking for comparable sites and stands. Stocking may be measured in terms of number of trees, volume, basal area, cover canopy, or other criteria.

> NONSTOCKED AND OTHER AREAS NOT ELSEWHERE CLASSIFIED.—Areas not qualifying as sawtimber, poletimber, or seedling-and-sapling stands.
>
> POORLY STOCKED STANDS.—Stands that are 10 to 39 percent stocked with present or potential growing stock trees.
>
> WELL- AND MEDIUM-STOCKED STANDS.—Stands that are 40 percent or more stocked with present or potential growing stock trees.

Timber Volume

GROWING STOCK.—Net volume, in cubic feet, of live sawtimber trees and live poletimber trees from stump to a minimum 4-inch top (of central stem) inside bark. (Deductions are made for rot only. Volume in rough standard cords, bark included, is derived from cubic-foot volume by applying a factor of 80 cubic feet per cord.)

SAWTIMBER VOLUME.—Net volume in board-feet, International ¼-inch rule, of live and salvable dead sawtimber trees of commercial species to a merchantable top. (The merchantable top diameter, inside bark, is 6 inches in softwoods and 8 inches in hardwoods. Deductions are made for both sound defect and rot. The volume of salvable dead trees is negligible.)

A. STANDARD LUMBER LOGS

Grade factors	Grade 1			Grade 2		Grade 3
	Butts only	Butts and uppers		Butts and uppers		Butts and uppers
Diameter, minimum ... inches	13–15	16–19	20+		11	8+
Length, minimum ... feet	10+		10+	8–11	12+	8+
Clear cuttings, on the 3 best faces:						
Length, minimum ... do	7	5	3		3	2
Number on face, maximum	2		2	2	3	(2)
Yield in face length, minimum	5/6		5/6		4/6	3/6
Sweep and crook deduction, maximum ... percent	15		15		30	50
Cull deduction, including sweep, maximum ... do	40		40		50	50
Sound end defects, maximum [3]						

Source: Hardwood Log Grades for Standard Lumber. U. S. Forest Products Lab. No. D1737–A. 1949. [Processed.]

[1] *Exceptions*: Ash and basswood Grade 1 butts, 12-inch d. i. b.

Grade 2, 10-inch d. i. b. must be Grade 1 surface quality.

Grade 2, 11-inch d. i. b. limited to 2 cuttings.

Grade 2, 8- and 9-foot lengths limited to 12-inch d. i. b.; ¾ yield in cuttings not more than 3+ feet.

Sweep and crook allowance reduced ⅓ in logs with more than ¼ diameter in sound end defects.

60 percent cull deduction permitted in Grade 2 if otherwise of Grade 1 quality.

60 percent cull deduction permitted in Grade 3 if otherwise of Grade 2 quality.

[2] Unlimited.

[3] Not visible in standing timber.

B. TIE AND TIMBER LOGS

Position in tree	Butt and upper
D. i. b., small end, inches	8+
Length without trim, feet	8+
Clear cuttings	No requirements. Not graded on cutting basis.
Sweep allowance, maximum	¼ d. i. b. of small end for half logs and ½ d. i. b. for log 16 feet long.
Sound surface defects permitted:	
Single knots	Any number, if none has an average collar diameter in excess of ⅓ of log diameter at point of occurrence.[1]
Whorled knots	Any number provided the sum of the collar diameters does not exceed ⅓ the log diameter at point of occurrence.
Holes	Any number not exceeding knot specifications if they do not extend over 3 inches into the contained tie or timber.
Unsound defects permitted:	
Surface	Any number and size if they do not extend into contained tie or timber. If they extend into contained tie and timber they shall not exceed size, number, and depth of limits of sound knots.
Interior	None permitted except one shake not more than ⅓ the width of contained tie or timber and one split not over 5 inches long.

[1] Knot collar is the average of the vertical and horizontal diameters of the limb or knot swelling as measured flush with the surface of the log.

Growth and Annual Cut

NET ANNUAL GROWTH OF SAWTIMBER.—The change during a specified year in net board-foot volume of live sawtimber on commercial forest land resulting from natural causes.

INGROWTH OF SAWTIMBER.—The total net board-foot volume of trees that entered live sawtimber during the inventory year as measured at the end of the year.

ANNUAL MORTALITY OF SAWTIMBER.—The net board-foot volume removed from live sawtimber on commercial forest land during a specified year through death from natural causes.

NET ANNUAL GROWTH OF GROWING STOCK.—The change during a specified year in net cubic-foot volume of growing stock on commercial forest land resulting from natural causes.

INGROWTH OF GROWING STOCK.—The total net cubic-foot volume of trees that entered growing stock during the inventory year as measured at the end of the year.

ANNUAL MORTALITY OF GROWING STOCK.—The net cubic-foot volume removed from growing stock during a specified year through death from natural causes.

ANNUAL CUT OF LIVE SAWTIMBER.—The board-foot volume of live sawtimber trees cut or killed by logging on commercial forest land during a specified year.

ANNUAL CUT OF GROWING STOCK.—The cubic-foot volume of live sawtimber and poletimber trees cut or killed by logging on commercial forest land during a specified year.

Forest Survey Methods

Estimates of forest area, timber volume, and tree growth in New Hampshire are based on data obtained from sample plots that were first located on aerial photographs. These plots were distributed uniformly over the entire State. Trained photointerpreters examined the photos and classified each plot according to stand size. Field crews then inspected enough plots on the ground to attain a specified level of statistical accuracy. Species, volume, and growth data were collected on these ground plots.

Growth was computed from measurements of tree rings on increment cores taken from sample trees. These data were used in estimating the diameter distribution of each species 10 years hence. Future volume was predicted from this new distribution of diameters. Growth was then determined by subtracting present net volume from estimated future net volume and reducing the difference to an annual basis. Allowances were made for ingrowth and for loss of growth on dead and cut trees.

Estimates of timber cut for sawlogs, veneer, cooperage, and pulpwood were derived from production data largely supplied by the New Hampshire Forestry and Recreation Commission (*9*). Fuelwood and fence-post production was estimated from data obtained by field surveys of farmers and other consumers. Output of other products was estimated from field surveys of producers or consuming mills.

Special woods and mill studies were conducted to determine the class of material being cut, i. e., whether sawtimber or poletimber growing stock, and proportion coming from cull and dead trees, mill residues, and other similar sources. Estimates of logging residues were derived from a special study of logging operations throughout the State.

In order that all production from New Hampshire timber would be accounted for, adjustments were made for shipments of sawlogs and pulpwood into the State and for a small net export of veneer logs, cooperage bolts, and similar material.

Reliability of the Estimates

The estimates in this report may contain two kinds of error. First, photointerpreters may make mistakes in judgment and fieldmen may make mistakes in measuring or recording. There is no practical way of finding out just how often such errors occur. But they are kept to a minimum by closely checking all phases of the work.

The second kind of error is inherent in sampling procedures. The size of this possible error can be measured. If there are no errors of the first kind, the probabilities are 2 out of 3 that the estimated State figures for areas and volumes do not vary from the actual areas and volumes by more than the following percentages:

	Percent (plus or minus)
Forest land area	0. 6
Sawtimber area	3. 9
Poletimber area	5. 2
Timber volume, board-foot basis	3. 9
Timber volume in sawtimber stands, board-foot basis	5. 4
Timber volume in poletimber stands, cubic-foot basis	6. 0
Total timber volume, cubic-foot basis	2. 4
Growth (board-foot basis)	8. 0
Growth (cubic-foot basis)	7. 1
Timber cut (cubic-foot basis)	7. 2

In every case, total figures are more reliable than subtotals, subtotals are more reliable than any of their component figures. Figures that are small in relation to totals are subject to larger sampling errors.

Species Tallied

The various tree species (7) tallied in New Hampshire are listed below.

SOFTWOODS

Spruce:	
Red spruce	*Picea rubens*
White spruce	*P. glauca*
Black spruce	*P. mariana*
Fir (balsam fir)	*Abies balsamea*
Hemlock (eastern hemlock)	*Tsuga canadensis*

SOFTWOODS—Continued

White pine:	
Eastern white pine	*Pinus strobus*
Red pine	*P. resinosa*
Pitch pine	*P. rigida*
Other softwoods:	
Northern white-cedar	*Thuja occidentalis*
Atlantic white-cedar	*Chamaecyparis thyoides*
Eastern redcedar	*Juniperus virginiana*
Tamarack	*Larix laricina*

HARDWOODS

Sugar maple	*Acer saccharum*
Red maple	*A. rubrum*
Red oak (northern red oak)	*Quercus rubra*
Yellow birch	*Betula alleghaniensis*
Paper birch	*B. papyrifera*
Beech (American beech)	*Fagus grandifolia*
Ash	*Fraxinus* spp.
Aspen	*Populus* spp.
Other hardwoods:	
White oak	*Quercus alba*
American basswood	*Tilia americana*
Elm	*Ulmus* spp.
Hickory	*Carya* spp.
Butternut	*Juglans cinerea*
Willow	*Salix* spp.
Sweet birch	*Betula lenta*
Black cherry	*Prunus serotina*

Supplementary Tables

TABLE 9.—*Commercial forest-land area of New Hampshire, by stand-size class and forest type group, 1948*

Stand-size class	Forest type group				All forest types	
	White pine	Spruce-fir	Aspen-paper birch	Hardwood		
	Acres	*Acres*	*Acres*	*Acres*	*Acres*	*Percent*
Sawtimber stands:						
More than 5,000 board-feet per acre	266,100	79,600	4,500	231,200	581,400	13
1,500–5,000 board-feet per acre	444,600	157,200	12,600	612,500	1,226,900	26
Poletimber stands	352,900	286,800	93,600	1,002,700	1,736,000	37
Seedling-and-sapling	174,200	67,600	235,800	460,200	937,800	20
Nonstocked areas	101,600	16,100	34,800	47,600	200,100	4
Total	1,339,400	607,300	381,300	2,354,200	4,682,200	100

Table 10.—*Live timber volume on commercial forest land of New Hampshire, by tree diameter, 1948*

Diameter class, cumulative (inches)	Growing stock	Sawtimber	Diameter class, cumulative (inches)	Growing stock	Sawtimber
	Million cubic-feet	*Million board-feet*		*Million cubic feet*	*Million board feet*
Softwood:			Hardwood:		
26+	42	262	26+	50	274
24+	60	364	24+	85	439
22+	96	570	22+	134	666
20+	173	1, 010	20+	203	995
18+	289	1, 656	18+	304	1, 474
16+	453	2, 517	16+	440	2, 108
14+	657	3, 521	14+	618	2, 918
12+	914	4, 735	12+	815	3, 802
10+	1, 194	5, 911	10+	1, 125	----------
8+	1, 569	----------	8+	1, 536	----------
6+	1, 891	----------	6+	1, 931	----------
			Total	3, 822	9, 713

Table 11.—*Live timber volume on commercial forest land of New Hampshire, by stand-size class, and species group, 1948*

Stand-size class	Growing stock			Sawtimber			Area
	Softwood	Hardwood	Total	Softwood	Hardwood	Total	
	Million cubic feet	*Million cubic feet*	*Million cubic feet*	*Million board-feet*	*Million board-feet*	*Million board-feet*	*Acres*
Sawtimber stands:							
More than 5,000 board-feet per acre	674	457	1, 131	2, 834	1, 534	4, 368	581, 400
1,500–5,000 board-feet per acre	667	714	1, 381	2, 154	1, 603	3, 757	1, 226, 900
Poletimber stands:							
More than 600 cubic feet per acre	309	469	778	406	332	738	894, 800
200–600 cubic feet per acre	123	203	326	203	185	388	841, 200
Other stands	118	88	206	314	148	462	1, 137, 900
All stands	1, 891	1, 931	3, 822	5, 911	3, 802	9, 713	4, 682, 200

Table 12.—*Live timber volume on commercial forest land of New Hampshire, by forest type group, 1948*

Forest type group	Growing stock		Sawtimber	Forest type group	Growing stock		Sawtimber
	Million cubic feet	*Thousand cords*	*Million board-feet*		*Million cubic feet*	*Thousand cords*	*Million board-feet*
White pine (1,339,400 acres)	1, 244	15, 500	3, 806	Hardwood (2,354,200 acres)	1, 838	23, 000	4, 441
Spruce-fir (607,300 acres)	605	7, 600	1, 281				
Aspen-paper birch (381,300 acres)	135	1, 700	185	All types (4,682,200 acres)	3, 822	47, 800	9, 713

TABLE 13.—*Live timber volume on commercial forest land of New Hampshire, by species and stand-size class, 1948*

GROWING STOCK

Species	Sawtimber stands	Poletimber stands	Other stands	Total	
	Million cubic feet	*Million cubic feet*	*Million cubic feet*	*Million cubic feet*	*Percent*
Softwoods:					
White pine	646	153	71	870	23
Spruce	248	96	10	354	9
Hemlock	252	50	23	325	8
Fir	166	114	11	291	8
Other softwoods	29	19	3	51	2
Total	1,341	432	118	1,891	50
Hardwoods:					
Yellow birch	305	100	8	413	11
Red maple	172	144	15	331	9
Sugar maple	203	85	11	299	8
Paper birch	139	139	22	300	8
Beech	170	38	5	213	5
Red oak	89	57	11	157	4
Other hardwoods	93	109	16	218	5
Total	1,171	672	88	1,931	50
All species	2,512	1,104	206	3,822	100

SAWTIMBER VOLUME

Species	Sawtimber stands	Poletimber stands	Other stands	Total	
	Million board-feet	*Million board-feet*	*Million board-feet*	*Million board-feet*	*Percent*
Softwoods:					
White pine	2,763	283	195	3,241	34
Hemlock	985	114	87	1,186	12
Spruce	748	107	14	869	9
Fir	386	80	8	474	5
Other softwoods	106	25	10	141	1
Total	4,988	609	314	5,911	61
Hardwoods:					
Yellow birch	1,057	142	40	1,239	13
Sugar maple	660	77	46	783	8
Beech	470	53	3	526	5
Red maple	289	76	8	373	4
Paper birch	263	67	13	343	4
Red oak	243	46	22	311	3
Other hardwoods	155	56	16	227	2
Total	3,137	517	148	3,802	39
All species	8,125	1,126	462	9,713	100

TABLE 14.—*Live timber volume on commercial forest land of New Hampshire, by forest type group and stand-size class, 1948*

GROWING STOCK

Forest type group	Sawtimber stands: More than 5,000 board-feet per acre	Sawtimber stands: 1,500–5,000 board-feet per acre	Poletimber stands	Other stands	Total
	Million cubic feet	*Million cubic feet*	*Million cubic feet*	*Million cubic feet*	*Million cubic feet*
White pine	503	448	201	92	1, 244
Spruce-fir	159	232	213	1	605
Aspen-paper birch	11	15	80	29	135
Hardwood	458	686	610	84	1, 838
Total	1, 131	1, 381	1, 104	206	3, 822

SAWTIMBER VOLUME

Forest type group	Sawtimber stands: More than 5,000 board-feet per acre	Sawtimber stands: 1,500–5,000 board-feet per acre	Poletimber stands	Other stands	Total
	Million board-feet	*Million board-feet*	*Million board-feet*	*Million board-feet*	*Million board-feet*
White pine	2, 093	1, 299	225	189	3, 806
Spruce-fir	543	537	192	9	1, 281
Aspen-paper birch	39	37	55	54	185
Hardwood	1, 693	1, 884	654	210	4, 441
Total	4, 368	3, 757	1, 126	462	9, 713

National Standard Tables

To facilitate compilation of forest survey data for any group of States, region, or the Nation as a whole, a standard set of tables is presented in the forest survey report on each State. These tables contain information on forest area, ownership, timber volume, growth, and drain. The following tables present this information for the State of New Hampshire.

TABLE 15.—*Land area by major classes of land, New Hampshire, 1948*

Class of land	Area
	Thousand acres
Forest:	
Commercial	4, 682
Noncommercial:	
Productive-reserved	25
Unproductive [1]	141
Total	4, 848
Nonforest [2]	927
Total, all classes	5, 775

[1] Includes 62,000 acres withdrawn for special uses.

[2] Includes 56,000 acres of water according to survey standards of area classification but defined by the Bureau of the Census as land.

TABLE 16.—*Commercial forest land area by ownership and stand-size classes, New Hampshire, 1948*

Ownership class	Sawtimber stands	Poletimber stands	Seedling-and-sapling stands	Nonstocked [1]	Total
	Thousand acres	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*
Federal:					
National forest	314	184	66	16	580
Other		4	1		5
Total	314	188	67	16	585
State	12	26	7		45
County and municipal	10	14	26	2	52
Private:					
Farm	378	273	313	76	1, 040
Industrial and other	1, 094	1, 235	525	106	2, 960
Total	1, 472	1, 508	838	182	4, 000
All ownerships	1, 808	1, 736	938	200	4, 682

[1] Includes areas not classified elsewhere.

Table 17.—*Area of commercial forest land by major forest types, New Hampshire, 1948*

Forest type	Area
	Thousand acres
White-red-jack pine	1, 339
Spruce-fir	607
Oak-hickory	95
Elm-ash-cottonwood	90
Maple-beech-birch	2, 170
Aspen-birch	381
Total	4, 682

Table 18.—*Net volume of live sawtimber and growing stock on commercial forest land by stand-size class, New Hampshire, 1948*

Stand-size class	Sawtimber	Growing stock
	Million board-feet	*Million cubic feet*
Sawtimber stands	8, 125	2, 512
Poletimber stands	1, 126	1, 104
Seedling-and-sapling stands	396	172
Nonstocked and other areas not classified elsewhere	66	34
Total	9, 713	3, 822

Table 19.—*Net volume of live sawtimber and growing stock on commercial forest land by ownership class, New Hampshire, 1948*

Ownership class	Sawtimber	Growing stock
	Million board-feet	*Million cubic feet*
Federal:		
National forest	1, 607	645
Other	7	2
Total	1, 614	647
State	57	38
County and municipal	57	28
Private:		
Farm	2, 212	843
Industrial and other	5, 773	2, 266
Total	7, 985	3, 109
All ownerships	9, 713	3, 822

Table 20.—*Net volume of live sawtimber and growing stock on commercial forest land by species, New Hampshire, 1948*

Species [1]	Sawtimber	Growing stock
	Million board-feet	*Million cubic feet*
Softwoods:		
Spruce and balsam fir	1, 343	645
White and red pines	3, 241	870
Hemlock	1, 186	325
Other eastern softwoods	141	51
Total softwoods	5, 911	1, 891
Hardwoods:		
White oak [2]	38	27
Red oak [3]	311	157
Yellow birch	1, 239	413
Sugar maple	783	299
Red maple	373	331
Beech	526	213
Ash	92	54
Aspen	15	38
Basswood	31	5
Other eastern hardwoods [4]	394	394
Total hardwoods	3, 802	1, 931
All species	9, 713	3, 822

[1] Species from the national standard list that do not appear here are either not present in New Hampshire or were found so infrequently that no reliable estimate of volume could be made.

[2] Includes only *Quercus alba.*

[3] Includes only *Quercus rubra.*

[4] Includes 343,000,000 board-feet or 300,000,000 cubic feet of paper birch.

Table 21.—*Net volume of all timber on commercial forest land by class of material and species group, New Hampshire, 1948*

Class of material	Softwoods	Hardwoods	Total
Growing stock:	*Million cubic feet*	*Million cubic feet*	*Million cubic feet*
Sawtimber trees:			
Sawlog portion	1, 089	580	1, 669
Upper stem portion	95	235	330
Total	1, 184	815	1, 999
Poletimber trees	707	1, 116	1, 823
Total growing stock	1, 891	1, 931	3, 822
Other material:			
Sound cull trees	148	118	266
Rotten cull trees	26	299	325
Hardwood limbs [1]	--------	141	141
Salvable dead trees	(2)	(2)	(2)
Total other material	174	558	732
Total, all timber	2, 065	2, 489	4, 554

[1] Limbs of live hardwood sawtimber trees.

[2] Negligible.

TABLE 22.—*Net volume of live sawtimber on commercial forest land by diameter class and species, New Hampshire, 1948*

Species [1]	Diameter class (inches)						Tota
	10	12	14	16	18	20+	
	Million board-feet	*Million board-feet*	*Million board-feet*	*Million board-feet*	*Million board-feet*	*Million board-feet*	*Million board-feet*
Softwoods:							
White and red pines	511	606	527	552	407	638	3,241
Other eastern softwoods	665	608	477	309	239	372	2,670
Total	1,176	1,214	1,004	861	646	1,010	5,911
Hardwoods:							
White oak [2]		19	3	3	2	11	38
Red oak [3]		98	73	43	22	75	311
Yellow birch		180	205	208	181	465	1,239
Sugar maple		127	137	114	111	294	783
Beech		141	133	95	81	76	526
Other eastern hardwoods		319	259	171	82	74	905
Total		884	810	634	479	995	3,802
All species	1,176	2,098	1,814	1,495	1,125	2,005	9,713

[1] Includes all of the species listed in table 20, but they have been grouped further to permit a valid breakdown by diameters.

[2] Includes only *Quercus alba.*

[3] Includes only *Quercus rubra.*

TABLE 23.—*Net annual growth, annual mortality, and annual cut of live sawtimber and growing stock on commercial forest land by species group, New Hampshire, 1952*

Item	Sawtimber			Growing stock		
	Softwoods	Hardwoods	Total	Softwoods	Hardwoods	Total
	Million board-feet	*Million board-feet*	*Million board-feet*	*Million cubic feet*	*Million cubic feet*	*Million cubic feet*
Net annual growth	259	213	472	80	132	212
Annual mortality	84	56	140	29	23	52
Annual cut:						
Timber products	258	64	322	66	22	88
Logging residue	16	5	21	8	2	10
Total	274	69	343	74	24	98

Table 24.—*Output of timber products and annual cut of live sawtimber and growing stock, New Hampshire, 1952*

Product	Output of timber products					Annual cut of sawtimber			Annual cut of growing stock		
	Volume in standard units		Roundwood volume								
	Standard units	Number	Total	Softwoods	Hardwoods	Total	Softwoods	Hardwoods	Total	Softwoods	Hardwoods
			M cubic feet	*M cubic feet*	*M cubic feet*	*M board-feet*	*M board-feet*	*M board-feet*	*M cubic feet*	*M cubic feet*	*M cubic feet*
Sawlogs	M board-feet [1]	297, 023	58, 856	51, 990	6, 866	253, 926	223, 787	30, 139	65, 136	56, 917	8, 219
Veneer logs and bolts	do	14, 055	2, 423		2, 423	14, 940		14, 940	2, 907		2, 907
Cooperage logs and bolts	do	12, 280	2, 898	2, 800	98	6, 958	6, 635	323	2, 928	2, 821	107
Pulpwood	Standard cords [2]	[3] 247, 513	19, 821	13, 569	6, 252	60, 636	42, 118	18, 518	19, 473	13, 600	5, 873
Fuelwood	do	[4] 141, 815	10, 700	1, 058	9, 642	4, 724	645	4, 079	6, 993	760	6, 233
Piling	M linear feet	245	147	132	15	718	646	72	155	139	16
Poles	M pieces	3	34	34		149	149		35	35	
Posts	do	370	320	224	96	29	16	13	314	221	93
Miscellaneous [5]	M cubic feet	317	317	21	296	1, 258	97	1, 161	339	24	315
Total			95, 516	69, 828	25, 688	343, 338	274, 093	69, 245	98, 280	74, 517	23, 763

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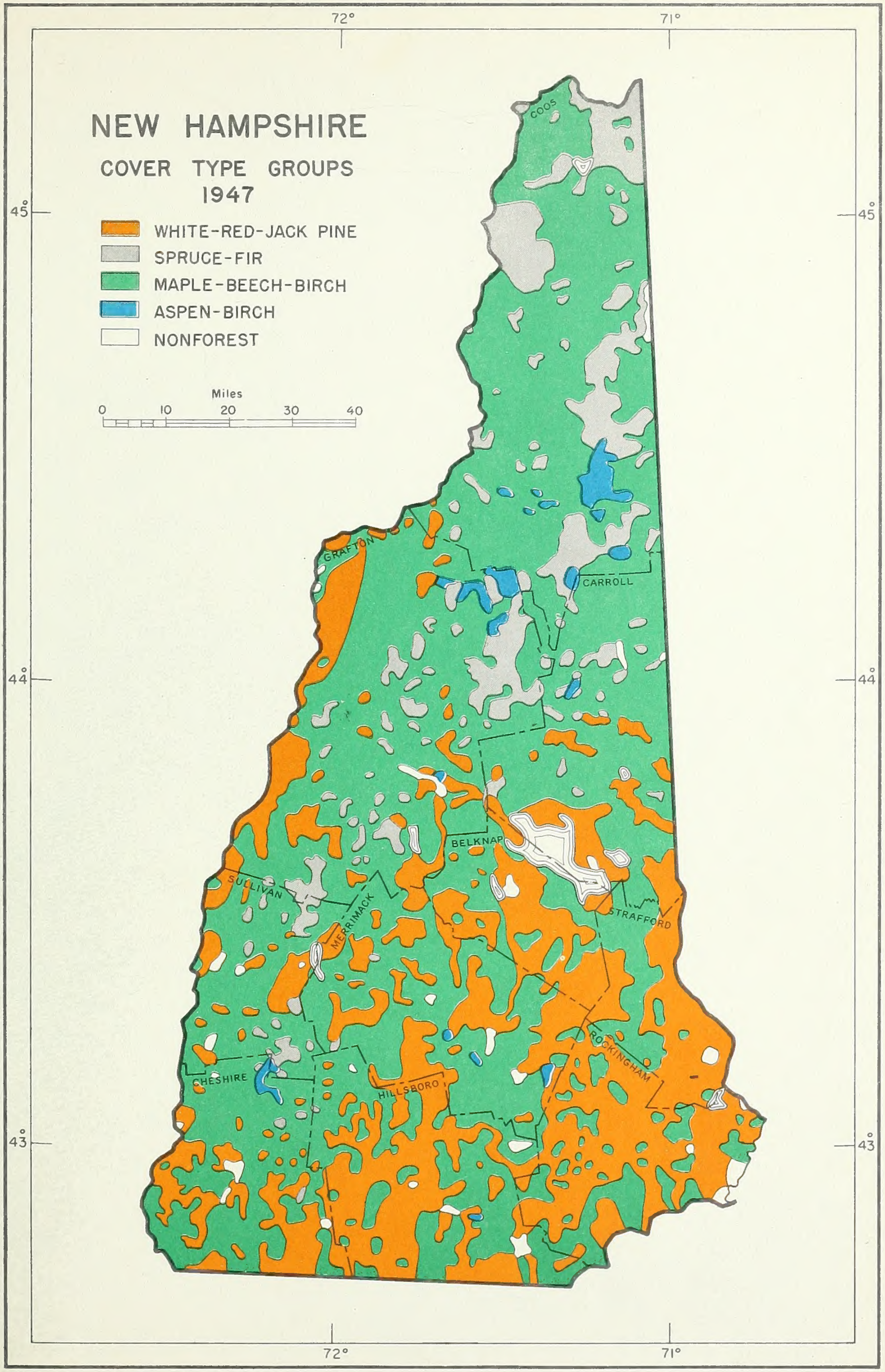
[1] International ¼-inch rule.

[2] Rough-wood basis.

[3] Not including 159,000 cubic feet of wood from mill residues used for pulp.

[4] Not including 6,839,000 cubic feet of wood from mill residues used for domestic and industrial fuel.

[5] Includes excelsior bolts, handle stock, shingle bolts, chemical wood, farm timbers, etc.



NEW HAMPSHIRE

COVER TYPE GROUPS

1947

🟧 WHITE-RED-JACK PINE

⬜ SPRUCE-FIR

🟩 MAPLE-BEECH-BIRCH

🟦 ASPEN-BIRCH

☐ NONFOREST

☆U. S. GOVERNMENT PRINTING OFFICE : 1954 O—302642